The Origins of Operational Depth in the First World War

A Monograph

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Modern scholarship on the Great War provided effective models on operational innovation and adaptation. However, the vital concept of operational depth remained unanalyzed. An examination of the challenge and response dynamic among the Germans, British, French, and United States' employment of fire support created the framework to examine this emergence. Each participant entered the war with unique theories that shaped their doctrine, structure, and tactics. The tenets of operational depth that stand out are the requirement for rearward depth, synchronization for the penetration, and forward depth. Rearward depth required logistical preparation, communications, and tactical dispersion. The initial penetration required a synchronized combined arms attack to move efficiently through the enemy's tactical depth. Forward depth relied on surprise, simultaneity, and mobility to draw combat power away from the point of penetration and continue the movement into the operational depth. An understanding of the emergence of operational depth and its principles serve as a model for incorporating new capabilities into modern warfare.

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Abstract

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Modern scholarship on the Great War provided effective models on operational innovation and adaptation. However, the vital concept of operational depth remained unanalyzed. An examination of the challenge and response dynamic among the Germans, British, French, and United States' employment of fire support created the framework to examine this emergence. Each participant entered the war with unique theories that shaped their doctrine, structure, and tactics. After the onset of trench warfare, an attacker needed to penetrate an enemy's tactical depth into their operational depth faster than they could reinforce by rail. The Allies experimented with large concentrations of artillery, which led the Germans to develop a defense in depth. After a series of costly failures, the French and British countered this practice with a 'bite and hold' method that seized a piece of defensible terrain to defeat the clockwork German counterattack. The Germans chose the path of tactical excellence to achieve operational depth with the development of neutralization and infiltration tactics. The United States fused the 'bite and hold' with the principles of open warfare. Artillery served as the catalyst, problem, and solution that led to operational depth. The tenets of operational depth that stand out are the requirement for rearward depth, synchronization for the penetration, and forward depth. Rearward depth required logistical preparation, communications, and tactical dispersion. The initial penetration required a synchronized combined arms attack to move efficiently through the enemy's tactical depth. Forward depth relied on surprise, simultaneity, and mobility to draw combat power away from the point of penetration and continue the movement into the operational depth. An understanding of the emergence of operational depth and its principles serve as a model for incorporating new capabilities into modern warfare.

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Acronyms

ADP	Army Doctrine Publication
ADRP	Army Doctrine Reference Publication
AEF	American Expeditionary Force
BEF	British Expeditionary Force
FSR	*Field Service Regulations*

Introduction

> *Depth* is the very essence of the evolving modern operation, and it is this essence that accounts for the operation's enormous intensity.
>
> -Georgii Samoilovich Isserson, *The Evolution of Operational Art*

Before the autumn of 1914, the concept of depth remained shackled to the limit of the commander's eye. This narrow perception centered on the employment of fresh troops against a weakened or disorganized enemy to attain a decisive advantage. This concept of tactical depth denies an enemy the ability to maneuver and inflict damage with minimal effort. The introduction of new technology such as accurate and rapid firing artillery sparked a coevolution among the Allied and Central powers, which transformed the concept of depth beyond its tactical origin.[1] By 1918, firepower empowered the commander to strike at the enemy throughout their tactical depth, preventing the use of reserves, command and control, and resupply. This capability characterized operational depth because it enabled operational maneuver to destroy an enemy without engaging the majority of its defenses.[2] Therefore, emergence of operational depth and the rise of modern artillery became intrinsically linked. J.B.A. Bailey identified the framework for the evolution of fire support during the Great War. This evolution occurred over four distinct phases: the recognition in 1914 that current practices were insufficient, the experimentation with new tactics in 1915, the failure of "massive destruction" in 1916-1917, and the evolution to neutralization from 1917-1918. [3] The common thread for all four phases is that fire support played the most decisive role in shaping the concept of depth. Therefore, the challenge and response dynamic between the German and Allied employment of firepower in World War I created the catalyst that

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[1] Bruce I. Gudmundsson, *On Artillery* (Westport, CT: Praeger, 1993), 5.

[2] Charles L. Crow, "Tactical and Operational Depth" (SAMS thesis, School of Advanced Military Studies, 1986), 2-3.

[3] J.B.A Bailey, ed., *Field Artillery and Fire Power* (Annapolis, MD: Naval Institute Press, 2004), 127.

led to the emergence of operational depth, which became characterized by synchronization for the initial penetration, forward, and rearward depth.

Today, the concept of depth stands out as one of the most essential, but overlooked, tenets of the operational art and doctrine. ADP 3-0 defines operational art as the "pursuit of strategic objectives, in whole or in part, through the arrangement of tactical actions in time, space, and purpose."[4] This simple yet powerful term is not associated with a specific level of war. Instead, it determines how a commander arranges multiple tactical actions in time and space to achieve a higher strategic purpose. The concept of depth remains a critical part of operational art because it shapes how a commander balances risk and opportunities. Depth requires a balance of "tempo and momentum" to produce a synchronized result.[5] Any increase in dispersion results in a decreased ability to concentrate while improving overall resilience of an organization. This equilibrium cannot be achieved through a straightforward algebraic equation. Instead, the commander must balance depth in a high-stakes exchange among equally important principles. Doctrine serves as the principle agent to translate a concept such as depth into action.

The central idea of the United States' current warfighting doctrine, *Unified Land Operations,* is that army units "seize, retain, and exploit the initiative to gain a position of relative advantage over the enemy."[6] This vision of warfare strives to defeat the enemy throughout the 'depth' of its organization.[7] From the operational perspective, *Unified Land Operations* details the guiding principles on the creation and use of combat power in campaigns and operations to achieve this defeat in depth. Army Doctrine Publication 3-0 defines depth as the "extension of

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[4] Army Doctrine Publication (ADP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 9.

[5] Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 2-14.

[6] ADP 3-0, 5.

[7] Ibid.

operations in space, time, or purpose."[8] This ability to arrange a series of tactical actions to strike throughout the length and breadth of a formation provides the most decisive outcome. This method prevents the use of reserves, command and control, and resupply. Additionally, depth provides resilience to a friendly force through the employment of reconnaissance, reserves, and security forces. However, the increase in depth creates new challenges to communication, mission command, protection, and concentration. The tradeoff between depth and mass is a vital concept needed in order to practice the operational art. Without an understanding of the operational art, the concept of depth remains limited and does not help achieve the overall intent of *Unified Land Operations*.[9] Depth evolved with operational art throughout the course of modern warfare. An examination of this evolution would provide a wider framework to understand this vital principle. An exploration in reverse of this evolution provides the most coherent window into the concept of depth.

Unified Land Operations remains the spiritual successor to *AirLand Battle*, which shares the same theoretical foundation on depth. The introduction of *AirLand Battle* in 1982 is not the origin of "seeing deep" in the United States doctrine and concept of the operational art. However, it is an important artifact for the idea of depth.[10] General Donn A. Starry argued that extending the battlefield is not a new concept.[11] Instead, this doctrine sought to disrupt the multiple Soviet echelons on the plains of central Europe through firepower beyond the front line.[12] The extension of the battlefield enabled the disruption of enemy timetables, frustrated his command and control,

[8] ADP 3-0, 8.

[9] Thomas Bruscino, "The Theory of Operational Art and Unified Land Operations" (Theoretical Paper, School of Advanced Military Studies Theoretical Paper, 2011), 21.

[10] Robert M. Citino, *Blitzkrieg to Desert Storm: The Evolution of Operational Warfare* (Lawrence: University Press of Kansas, 2004), 261.

[11] Donn A. Starry "Extending the Battlefield," *Military Review* 61, no. 3, March 1981, 31.

[12] Ibid., 55.

and weakened his grasp of the initiative.[13] This framework came from a synthesis of Soviet theorists such as Mikhail Tukhachevsky and Georgii Isserson and the American way of warfare through attrition in depth. The Soviet proponents offered a new outlook on the concept of depth, but the United States' method of warfare had the concept of depth engrained in its DNA. Depth permeated the United States' experience through each conflict of the 20th century. In World War II, Korea, and Vietnam the United States had similar aims of disrupting multiple echelons as *AirLand Battle* through interdiction and deep fires.[14] The practice lacked the integration and synchronization required for the forecasted campaign in the Fulda Gap, but the practice remained an integral part of the United States' concept of the operational art. The Soviets, in contrast, saw 'depth' as a natural evolution from the failure of the "linear strategy" in World War I.[15] The development of depth is complex and not monocausal, but the Soviet and American concepts of depth and operational art share a common origin, the Great War.

Literature Review

The well documented scholarship on the evolution of fire support during World War I does not illustrate how operational depth emerged. The body of literature on World War I fire support focused more on the tactical and technical aspects of the evolution than its operational impact. This does not mean the insight into the evolution can be elevated to the operational level after careful study. For example, David T. Zabecki argued that the change in fire support in the German army was the result of a single man, Bruchmuller, and his staff.[16] This prematurely

[13] Jeffrey W. Long, *The Evolution of U.S. Army Doctrine: from Active Defense to Airland Battle and Beyond* (Fort Leavenworth, KS: Army Command and General Staff College, 1991), 60.

[14] *Field Service Regulation FM 100-5, Operations* (Washington, DC: Department of the Army, 1949), 7.

[15] Georgii Samoilovich Isserson, *The Evolution of Operational Art*, trans. Bruce Menning (Moscow: The State Military Publishing House of the USSR People's Defense Commissariat, 1937), 48.

[16] Zabecki, *Steel Wind: Colonel Georg Bruchmüller and the Birth of Modern Artillery*, 2.

retired colonel created a modern system of fire support that married synchronized fire support with a scheme of maneuver. This predilection towards tactical excellence could be used to characterize how the Germans attempted to achieve operational depth through fire support. Additionally, J.B.A. Bailey, in his work *Field Artillery and Firepower,* created the foundational study that outpaced the previous historically focused narratives. Bailey synthesized the principles of field artillery tactics and how these developed with experience against a background of changing strategy and technology.[17] Bruce Gudmundsson expanded upon Bailey's work with a study of the French and German evolution of fire support.[18] Together, these books provide a holistic examination of how fire support evolved, but it does not approach the topic of operational depth. Modern scholarship does not delineate how fire support led towards greater operational of depth. A medley of wartime doctrine, interwar reflection, and modern research contain the requisite knowledge to discern the origin of depth.

Recently, modern scholars incorporated a more complete study of the development of operational thought, but they do not delineate operational depth. Works such as of *Stormtroop Tactics, Dynamics of Doctrine, and Doctrine and Dogma* demonstrated that German offensive and defensive doctrine were products of incremental improvement and staff-work oriented methods. However, these works focus on the tactical dimensions of depth.[19] *Military Effectiveness Vol I* by Allan R. Millett and Williamson Murray explored the operational effectiveness of the French, British, and Germans. In particular, its focus on sustainment and firepower can be used to understand key facets of operational depth. *Historical Perspectives of the Operational Art* highlighted key operational strengths and shortfalls of the French and

[17] J.B.A Bailey, ed., *Field Artillery and Fire Power*, 3.

[18] Gudmundsson, *On Artillery*, vii.

[19] Timothy Lupfer, *The Dynamics of Doctrine: the Changes in German Tactical Doctrine During the First World War* (Fort Leavenworth, KS: Command and General Staff College, 1981), 5.

Germans during the Great War. Again, the scholarship failed to highlight the origins of depth. An examination of these works alongside modern studies on the evolution of fire support can help answer the gap on existing scholarship on the evolution of operational depth.

Therefore, it is critical to understand that the existing scholarship does not explain how or why fire support shaped the concept of depth during the course of the Great War. Instead, the literature detailed the evolution of fire support and its impact on tactics and operations. An examination of the theory, history, and doctrine among the British, French, German, and American operational experience for each phase would provide a window into the evolution of depth on the modern battlefield. This insight will provide an improved understanding of a key, but overlooked, phenomena of the Great War. Additionally, this study of an important pivot point in modern war will improve the overall understanding of the operational art and current doctrine.

This study analyzes the four distinct phases of the progress of fire support during the Great War to find the origins of operational depth. Each phase will be divided into a Section that will analyze the context, predominant theory, and doctrine in order to trace how fire support caused the coevolution of depth. The first Section will focus on the inferred experience from the Franco-Prussian, Boer, and Russo-Japanese wars. This starting point will be examined against the initial adaptations by innovators such as General Philippe Pétain and Hans Von Seeckt in late 1914. The lens of history, theory, and doctrine will trace the growth through the points of experimentations throughout 1915, the failures of 1916-1917, and the final manifestation of neutralization in 1918. The trace of this advancement will illustrate how fire support influenced the concept of depth within modern war. This study will search for patterns among each period through a careful examination of primary and secondary sources. This analysis will help reveal the challenge and response dynamic that led to the modern concept of depth. With this improved understanding through this framework, this monograph can contribute to the overall body of knowledge on the operational art.

Section 1
Pre-War Theory, History, Doctrine and the Failures of the Summer Offensives of 1914

Prior to World War I, the concept of depth existed among the British, French, and German armies as an underdeveloped concept. By the middle of the nineteenth century, the enormous changes in population, industry, and technology fundamentally led to an evolution of the operational art and within it depth. The unprecedented lethality of rifled weaponry combined with massive armies supported by railroads created the catalyst for change. These stimuli led to a lateral deployment extended throughout a theater on an extended front. Georgii Isserson articulated this change as the "Epoch of the Linear Strategy."[20] Once armies entered a theater, battles became distributed within a campaign. Operations required a greater depth over an extended period of time since dispersion required a series of blows against a field army or its base of support. Within the literature, depth remained deeply rooted in the tactics that win battles. However, operational art aims at winning the campaigns that support strategy.[21] Operational depth consists of two dimensions: friendly and enemy. On the eve of the Great War, depth, as an operational concept consisted of only the echelonment of an attack, which employed fresh troops to sustain an offensive through the enemy's depth. [22] The major powers of Europe perceived that mobility served as the primary vehicle to achieve this depth. Firepower from infantry and artillery served as an auxiliary to this aim. Additionally, logistical preparation remained clearly absent from all major combatants to sustain operations in depth. Lastly, the theoretical and doctrinal bedrock did not harness or mitigate the lethality of the technological innovations of smokeless powder, quick firing artillery, and the machinegun. An examination of the theory, doctrine, and

[20] Isserson, *The Evolution of Operational Art*, 18.

[21] Glen K. Otis, "The Ground Commander's View," in *On Operational Art*, ed. Clayton R. Newell and Michael D. Krause (Washington, DC: United States Army Center of Military History, 1994), 31.

[22] Edward Bruce Hamley, *The Operations of War Explained and Illustrated* (London: William Blackwood and Sons, 1866), 325.

historical events on the eve of World War I demonstrated how firepower served as the catalyst towards operational depth.

Pre-War Theory, History, and Doctrine: The French

Prior to the Great War, French theory of the operational art distorted tactical methods with complete ignorance of advancements in firepower. After the disasters of 1870, French military professionals initiated a period of modernization. These reforms created peacetime field armies and corps, which became the focal point for operational thought. By the 1890s, the French army moved to an active form of the defense, termed the "defensive-offensive strategy."[23] The 'Napoleonic' order in depth reinforced the thinner 'cordon like' formation of German design. Plan 16 in 1909 called for the 20th Corps posted at Nancy to screen and delay to protect the process of mobilization. A powerful army deployed behind the four front-line armies acted as a new "mass de maneuver."[24] Army groups sought to "impose on the enemy… battle under conditions which may lead to decisive results and end the war."[25] The regulations clearly stated that maneuver of the of army group derived from movement and battles of field armies whose subordinate corps acted in union. This immature concept of operational depth resembled a magnified Napoleonic *bataillon carré* that emphasized maneuver rather than firepower. This resurgence of Napoleonic thought led to a blur between the tactical and operational dimensions without understanding the impact of improved weaponry.[26]

The disastrous *offensive à outrance* doctrine thoughtlessly applied operational concepts to the tactical level to achieve operational depth through movement and concentration. In 1913, Comte de Grandmaison sought to employ large formations in the fashion of Napoleonic Corps.

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[23] Gat, *A History of Military Thought: from the Enlightenment to the Cold War*, 398.

[24] Ibid.

[25] Ibid.

[26] Robert A. Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940*, ed. Michael D Krause (Washington, DC: Military Bookshop, 2010), 75.

He summarized the operational doctrine with the statement that "The French Army returning to its traditions, recognizes no law save the offensive."[27] Although the doctrine did not abandon the call for dispersion as stated in the regulations of 1904, organizational inefficiency played a large role in the near defeat of 1914.[28] The generation of officers who fought the first battles of 1914 were weaned on Grandmaison's maxims, such as "to fight means to advance despite enemy fire."[29] In operational terms, the 'young Turks' rejected the expediency of the defense.[30] Additionally, the new doctrine did not address the danger that field guns could range 6.5 to 8 kilometers and inflict enormous casualties on mass formations with impunity through the use of indirect fire. [31] Additionally, the French did not incorporate a doctrine or common practice to allow close collaboration between the infantry and artillery to mitigate this danger. The French sought to achieve depth with the highly mobile, rapid fire, and close supporting *Soixante-Quinze* in massed open positions. As a result of this overreliance on the field gun, France had only 3,840 '75's and only 308 heavy guns on the onset of World War I.[32] The French could not attack effectively in depth through fires, but they believed they could balance momentum and tempo through mobility. The technical problem of target location and perceived difficulty of fire direction precluded indirect fire in a war of movement. Despite the French intent to achieve depth through mobility and aggressive action, its mass conscript armies did not have the training, logistics, field craft, heavy guns, or doctrine to attack judiciously in depth. The doctrine did not

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[27] Joseph Jacque Cesaire Joffre, *The Personal Memoirs of Joffre, Field Marshal of the French Army* (London: Harper & Brothers, 1932), 1:26.

[28] Paret, Craig, and Gilbert, eds., *Makers of Modern Strategy: from Machiavelli to the Nuclear Age*, 523.

[29] Louis De Grandmaison, *Dressage de L'Infanterie En Vue Du Combat Offensive* (Paris: Berger-Levrault, 1910), 89.

[30] Azar Gat, *A History of Military Thought: from the Enlightenment to the Cold War* (Oxford: Oxford University Press, 2002), 434.

[31] Gudmundsson, *On Artillery*,4.

[32] Ibid.

harness the strengths of the France, but instead coupled its national myth towards an unprecedented slaughter. Therefore, France entered World War I with an offensive focused method of warfare which sought to achieve depth through mass and mobility in order to overcome firepower. In essence, the French concept of depth magnified the prohibitive casualties in the summer offensive of 1914.

The French in adherence to their doctrine and Plan XVII went on the offensive in August 1914, which demonstrated a lack of operational depth. The first major engagement, the Battle of the Frontiers, which occurred on 16 to 23 August 1914 served as a harbinger for the French. The misplaced fervor and tactics of the *attaque à outrance* led to uncoordinated and poorly timed dense but piecemeal attacks, which shattered the French offensive.[33] The French, in practice, paid little attention to having tactical units as advance or flank guards. This denied the French the ability transition between tactical actions. Additionally, the infantry failed to coordinate their assaults with artillery. On the offensive, the French lacked operational depth due to organizational deficiency. Despite this inadequacy, the operational mobility enabled the French to avoid a larger defeat sixty miles outside Paris.

The French recovered at the Battle of the Marne due to an effective command and control system at the field army level. When the German communication system collapsed, the French continued to pass information effectively.[34] In addition, the French exploited a dense rail network to shift large formations of troops while the Germans culminated due to a deficiency of logistics. With these combined operational capabilities, Joffre could respond to the threat on his left wing by shifting troops and equipment from his right to his left.[35] Marshall Joffre ended mass

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[33] Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940*, 77.

[34] Hermann J. Von Kuhl, *The Marne Campaign* (Fort Leavenworth, KS: Command and General Staff College, 1936), 31.

[35] Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940*, 79.

unsupported frontal attacks. The field service note on 24 August 1914 instructed that, "the infantry should conduct its attack by a line of skirmishers with sufficient intervals; the strength of this line must be continually stained, and its advance must be supported by artillery; the advance should be kept up in this way until such a time as the assault may be made."[36] Although a tactical concern, this adherence to cult of the offensive led to 300,000 casualties, which impacted operational depth. When the German right flank became exposed, Joffre ordered a counter attack that saved Paris. The capability to conduct operational maneuver allowed the French to not lose the campaign despite horrendous losses. This operational maneuver was not continuous. Battles did not occur throughout the entire depth, but unfolded in separate sectors.[37] In order to achieve operational depth, the French needed to find a way to link individual tactical efforts along a continuous front in time and space to achieve a general aim. Yet the French would need to chart a new course, because mobility became second to firepower to attain depth. Firepower, principally artillery served as the primary agent of change.

Pre-War Theory, History, and Doctrine: The British

Prior to the Great War, British military theory was deeply rooted in tactics and, as a consequence, lacked operational depth. Edward Bruce Hamley's *The Operations of War* based on Jomini's logic of operations and Archduke Charles' geographical analysis served as the foundation of military thought.[38] Hamley saw operations as the link between tactics and strategy, but his notion of depth remained tactical. This theorist saw depth as only as a means to minimize the impact of firepower. This does qualify as operational depth because it does not extend operations in time, space, or purpose. Hamley's successors G.F.R. Henderson and John Fredrick

[36] General Staff War Office, *Field Service Regulations: Part I, Operations, 1909* (London: Royal Stationary Office, 1909), 26.

[37] Isserson, *The Evolution of Operational Art*, 26.

[38] Gat, *A History of Military Thought: from the Enlightenment to the Cold War*, 283.

Maurice did not see operations as the connection to tactics and strategy.[39] Maurice defined the campaign as "the large field of war which concerns the marches and movements of armies striving against one another to obtain positions of advantage for the actual combat, is the province of strategy."[40] This ideal became inculcated in the 1906 *Field Service Regulations,* which reflected an underdeveloped concept of operational depth.

British operational doctrine, the *Field Service Regulations of 1909 Part 1 Operations,* contained a series of principles for application by trained officers and a limited concept of operational depth. The *Field Service Regulations of 1909, Part I: Operations,* left to the subordinate commanders to decide on how to attack and sought to reunite tactics and strategy. Tactical units assigned as advance and flank guards were to identify enemy defenses, and thereafter units and formations should be directed on points of strategic and tactical importance on some distance ahead along objective lines.[41] This doctrine sought to wear down an opponent with the advance guard, pull in the reserve, conduct a decisive assault on a weakened enemy, and culminate with an exploitation. [42] This concept remained limited due to the regimental nature of the British and prevented the inclusion of an integrated doctrine capable of adequate support and combined arms.

Despite the concept of operational depth, the British doctrine reflected a "central ambiguity," which hampered the ability to achieve depth due to in ability to conduct combined arms.[43] The compartmentalized regimental system of the British army did not allow for bottom up or top down reform. The Arms Schools promoted and coordinated tactical doctrine, but they

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[39] John Andreas Olsen and Martin van Creveld, eds., *The Evolution of Operational Art: from Napoleon to the Present* (Oxford: Oxford University Press, 2011), 102.

[40] John F. Maurice, *War* (London: Macmillian, 1891), 8.

[41] General Staff War Office, *Field Service Regulations: Part I, Operations,* 91.

[42] Ibid., 131.

[43] Paddy Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18* (New Haven, CT: Yale University Press, 1996), 50.

could not overcome inter-service rivalry. The School of Musketry also did its best to incorporate of firepower and dispersion through official reports in 1908 and 1913, but it did not have the authority to affect meaningful change.[44] The experience of the colonial wars and preparation for a continental conflict could not coalesce behind a single vision needed to create the doctrine, material, training, and execution of maneuver warfare through operational depth. The British possessed the capability to employ fires depth, but technical and cultural obstacles served as fundamental barriers to employing fires in depth. The duty of the artillery was to assist the infantry to achieve fire superiority of the enemy infantry through mobile, close, and direct support. Shortly before the war, gun designers sacrificed range when producing a new gun carriage for the sake of mobility.[45] Furthermore, many British officers such as J.F.C. Fuller rejected the doctrine because "each concrete case demands its own particular solution."[46] The British entered the Great War with a doctrine that emphasized operational depth, but the inability to conduct combined arms hindered its use and acceptance.

During the first three months of the Great War, the battles fought by British Expeditionary Force (BEF) demonstrated origins of operational depth, which remained hindered by tactical inadequacy. At the Battle of Mons, the outnumbered British fought a successive series of rear guard actions against a German army three times its size. The use of the rear guard supported by artillery in accordance with *Field Service Regulation (FSR) 1909* prevented the French Fifth Army from being outflanked. This display of operational depth, albeit forced by the actions of the Germans, was in concert with the prescribed doctrine. At the First Battle of Ypres,

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[44] Shelford Bidwell and Dominick Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945* (London: George Allen and Unwin, 1982), 41.

[45] Paddy Griffith, ed., *British Fighting Methods in the Great War* (Portland, OR: Routledge, 1998), 24.

[46] Olsen and van Creveld, eds., *The Evolution of Operational Art: from Napoleon to the Present*, 109.

combined artillery and infantry fire nullified the mobility of the German army.[47] Yet the attempted counter-offensive at the Aisne River demonstrated the inability to combine artillery support with an infantry advance.[48] The British realized that any assault required a pre-arranged fire plan supported by intelligence on enemy locations and synchronized with the infantry scheme of maneuver. Without adequate artillery preparation, an assault became suicidal. The British increased the amount of field phones and telegraphs, which improved communications but limited mobility. Lastly, the proliferation of obstacles, particularly wire, stabilized the battlefield. Any obstacle covered by fire needed to be reduced by artillery prior to assault. Artillery served as the only reliable instrument to allow the infantry to effect a penetration. Yet, the British still required a solution to overcome problems in communication, command structures, and obstacles. [49] Any attempt to attack in depth without solving these fundamental problems led to counter-productive results. The exhausted British professionals needed to find new methods and hold on while the home islands mobilized the men and material for the decisive push to end the war.

Pre-War Theory, History, Doctrine: The Germans

Prior to the Great War, *Kesselschlacht,* the cauldron battle, characterized German military theory and a distinct view of operational depth. At the Battle of Cannae in 216 BCE, Hannibal encircled and annihilated a numerically superior Roman force. The *Kesselschlacht Doctrine* promulgated by Helmuth Von Moltke called for the encirclement of large enemy formations followed by a transition to a tactical defensive in order to allow firepower to destroy the enemy as it strived to break out of the cauldron.[50] Schlieffen magnified this concept with the

[47] Bailey, ed., *Field Artillery and Fire Power,* 129.

[48] Bidwell and Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945,* 68.

[49] Bailey, ed., *Field Artillery and Fire Power,* 129.

[50] Larry H. Addington, *The Patterns of War Since the Eighteenth Century,* 2nd ed. (Bloomington: Indiana University Press, 1994), 53.

idea of *Gesamatschlacht*, or total battle. This "integral operation" consisted of only one continuous movement, whose object was not a specific concentration of forces at a given place, but the unfolding dynamics of military actions against a whole country.[51] This method sought a encirclement of the enemy center of gravity. This replaced a mathematical concept of operations where the sum of the battles consisted of the campaign. Schlieffen envisioned a massive mobile, fluid, and self-sustaining envelopment. In order to overcome the tyranny of distance, the Germans utilized *Weisungsfuehrung*, or command by directive.[52] Directive command derived from von Moltke's maxim that "no plan of operations survives the first collision with the main enemy body."[53] This hierarchical structure provided depth at the operational level at the expense of synchronization, coordination, and integration among field armies. Therefore, the Germans fought to achieve operational depth through a decentralized command and control system.

German tactical doctrine provided a qualitative advantage over the French and British, which enabled greater operational depth through combat effectiveness. The Germans mirrored the concept of the "unconditional offensive spirit "of the French and British.[54] However, the fundamental difference is the Germans believed that firepower was primary in achieving a resolution, which differed from the British and French belief that victory lay at the end of a bayonet. Furthermore, in the 1906 edition of *Exerzier-Reglement Fur Die Infantrie*, emphasized this depth through firepower, mainly infantry and artillery coordination. This doctrine delineated that the effectiveness of the infantry attack in depth required a "broad field of fire" through the

[51] Paret, Craig, and Gilbert, eds., *Makers of Modern Strategy: from Machiavelli to the Nuclear Age*, 532.

[52] Matthew Fuhrmanna, Nathan Edwardsa, and Michael Salomonea, "The German Offensive of 1914: A New Perspective," *Defense and Security Analysis* 21, no. 1 (2005): 53.

[53] Martin Samuels, *Doctrine and Dogma: German and British Infantry Tactics in the First World War* (New York: Greenwood, 1992), 88.

[54] Ibid., 33.

integration of artillery, which took up positions 600m behind the infantry for improved coordination.[55]

In August of 1914, German field armies achieved operational depth through mobility and firepower. The Germans gained a strategic surprise through a gigantic flanking movement on the Allied left flank. However, a gap between the First and Second Armies allowed the French to counter-attack at the Marne River. As the Germans soldiers saw the outline of the Eiffel Tower, the Germans experienced a meaningful lesson of the danger of depth.[56] Clausewitz termed this situation as the culmination point where "most attacks only lead up to the point where their remaining strength is just enough to maintain a defense and wait for peace."[57] In addition, the *Weisungsfuehrung*, which provided tactical and operational flexibility, left the overall commander unable to shape the overall campaign. Yet Germans leadership could not orchestrate the tactical actions of its field armies in unison because of the extreme depth of the campaign. The German commander Moltke found himself passively awaiting communications that never arrived 150 miles behind his decisive right wing.[58] The inability to coordinate multiple field armies nearly proved disastrous in the Battle of the Marne. The German army could not sustain or communicate across the depth of the German advance. However, at the tactical level throughout the early campaign Germans possessed a marked advantage over the allies through the employment of firepower and use of tactical ground. The use of field howitzers enabled the Germans to inflict enormous damage by firing into dead space against the allies who could not respond effectively in kind. In addition, the task organization allowed the German commanders at the divisional level

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[55] Martin Samuels, C*ommand or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918* (London: Routledge, 1996), 160.

[56] BG Gunter R. Roth, *Historical Perspectives of the Operational Art: Operational Thought from Schlieffen to Manstein*, 154.

[57] Carl von Clausewitz, *On War, Indexed Edition*, Reprint ed. (Cambridge, MA: Princeton University Press, 1989), 566.

[58] Martin Van Creveld, *Command in War*, Reprint ed. (Cambridge, MA: Harvard University Press, 1987), 154.

to mass artillery. However, the logistical (mainly ammunition) problem diluted this tactical lead. Despite the advantages of integrated combined arms and heavy artillery, the Germans suffered from the same problems of communication, target location, and ammunition.

After the failure of the summer offensives, the impact of firepower radically changed the disposition and therefore the concept of operational depth within all major European field armies. The need for depth became apparent to all armies, but its practice had both serious conceptual and concrete obstacles. At the end of 1914, a line of trenches from the English Channel to the Swiss border demonstrated that firepower ascended in importance over mobility. The adoption of trench warfare was a clear response to firepower. Defensive artillery combined with machinegun and dispersed rifleman could extract prohibitive casualties on dense assault formations. However, the defenses lacked depth and all armies placed the preponderance of their forces on the first trench line.[59] Additionally, the vulnerability of field guns shattered the pre-war principle of massing artillery with the infantry to provide close support. In a common sense fashion, the artillery moved safely to the rear to use cover and concealment, but this depth compounded problem of communication and coordination. The Germans in particular demonstrated the potential of an attack in depth at the operational level, but also the tremendous danger without the supporting artillery, communication, logistics, and control. Without the synchronization of firepower and maneuver supported by adequate supply, depth served as a dangerous liability. The employments of firepower in depth within a combined arms team required a solution to the problems of ammunition, communication, observation, and control. These obstacles would require both theoretical, organizational and technical solutions. 1915 would be a year of experimentation, but firepower would remain the primary catalyst of change.

[59] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918,* 161.

Section 2
1915: Stabilization and Experimentation

The winter of 1914 to the end of 1915 on the Western Front witnessed a period of stabilization followed by experimentation with new techniques, organizations, and material. This period consisted of two major phases: the local attacks in the winter of 1914-1915 and the allied offensives of Artois from 9 May to 18 June 1915 and Champagne-Artois on 25 September 1915.[60] During the stabilization period, the French, British, and Germans created a network of trenches and shelters, bound together by communication trenches across the entire width of the Western Front. The British and French spent this period trying to find new ways to penetrate German defenses in order to restore a war of maneuver. Germany waged an economy of force defense with only limited attacks, because the Eastern Front was the main effort from late 1914 to 1917. Each country envisioned a short decisive campaign in the summer of 1914, which led to the use of the majority of the pre-war ammunition stockpiles. Therefore, the key ingredient, artillery ammunition, constrained the British and French to concentrating artillery on narrow fronts during limited offensives until the munition industry expanded.[61] This fundamental constraint prevented any meaningful operational depth. The second major problem of the continuous trench prevented an envelopment and a dense rail network allowed rapid reinforcement. With these problems in mind, the battles of 1915 experimented with concentrated firepower within battles with short achievable objectives, which had a decisive impact on how the French and British moved towards operational depth. Within these limited offensives, each country developed unique ways to overcome the problems of infantry and artillery communication, coordination, and control. The way each country adapted to these problems reflected the way they had prepared for mobile

[60] E Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918,* 34.

[61] Bailey, ed., *Field Artillery and Fire Power,* 129.

warfare.[62] An examination of theory, history, and doctrine of this experimental period revealed a decided shift towards harnessing depth through the use of artillery to achieve a penetration, but material shortages prevented any meaningful operational depth.

1915 Stabilization and Experimentation: The French

In the late fall of 1914 General Philippe Pétain, an advocate of systematic attacks, ascended as the theoretical architect of the French army. His methodical approach led to a series of minor victories, which resulted in national fame, promotion, and endorsement of his concepts by the General Staff. In a memorandum promulgated by Marshall Joffre on November 28, 1914, Pétain established a template for the attack in depth at the tactical level. This note called for the designation of a limited objective such as several trenches on a narrow front, deliberate and detailed reconnaissance, to include aerial photography, and a search for locations that would eliminate the danger of flanking fire on that limited objective. The infantry divided into groups that would assault the initial trench and those that would protect the flank. These teams would move in small-dispersed columns of infantry, reinforced with engineers equipped with ladders and Bangalore torpedoes to deal with wire obstacles. This attack would require a strict timetable for each unit's attack. The artillery would fire on the enemy trenches prior to the attack, subsequently lift its fire, and form a barrage behind the enemy's first trench. Additional artillery would fire on positions that flanked the objective.[63] This systematic approach provided a limited solution to the problem of coordination, communication, and obstacles through a centralized synchronization of infantry, engineers, and artillery. Yet, this method did not prevent the use of enemy reserves, command and control, and logistics both in and out of direct contact with friendly forces.[64] Instead, this incremental seize and hold technique only overwhelmed a small

[62] Gudmundsson, *On Artillery*,43.

[63] Ibid.

[64] ADP 3-0, 8.

portion of the line rather than arranging activities across the entire organizational depth. However, this method did increase the resiliency of the battered French armies. This approach would require a dramatic doctrinal shift from the exaggerated offensive to be successful.

The doctrine of Pétain's systematic approach derived from an adaptation of pre-war regulations on siege warfare. Due to the effects of enemy firepower and entrenchments, the French characterized operations in both "time and space by a slower and more methodical development."[65] Pétain tried to marry the *furia francese* with the tenets of siege warfare. First, the command needed to prepare an attack down to the smallest detail. Second, the success of every attack was subordinated to a strong artillery preparation, whose destructive effect opened the path for the infantry attack. Third, an attack needed to occur over a broad section of the line simultaneously, in order to deny the enemy an ability to concentrate its operational reserves. Additionally, a close cooperation between the infantry and artillery ensured the preparation and secondary objectives.[66] With this hybrid doctrine, the French achieved initial localized successes. However, limited French artillery, the power of German artillery, the dense rail system and the strength of the defense precluded any consequential operational depth.

The conduct of the French offensives in 1915 demonstrated a realization by the High Command that it could not attack throughout the whole depth of the German organization on the Western Front.[67] In February 1915, the Soissons-Perthes offensives attempted to deny the Germans the ability to transfer troops to the Russian Front. At the battle of Soissons, the French needed to destroy the German position systematically, because they could not "suppress, shock,

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[65] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 25.

[66] Jonathan Bailey, *The Dynamics of Military Revolution, 1300-2050*, ed. MacGregor Knox and Williamson Murray (Cambridge, MA: Cambridge University Press, 2001), 142.

[67] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 36.

and demoralize" with their existing field guns with a short bombardment.[68] This lack of medium and heavy artillery lengthened the duration of the fire plan, which sacrificed the element of surprise.[69] The Germans exploited this advantage on 12 January 1915 by erasing the salient through massed fire power. The ability to achieve surprise through concentrated firepower would remain a constant factor in the ability to leverage depth against an adversary.

The first battle of Perthes consisted of two corps attacking along a three-kilometer front supported by 100 guns batteries.[70] The French selected this narrow front due to limited available artillery. This operational decision proved the symbiotic relationship of firepower and depth as early as 1915. The initial wave seized its initial objectives, the artillery shifted to rear lines, and the French penetrated three kilometers. The attack broke down a series of factors that highlight the importance of depth. The narrow front allowed the enemy to concentrate all available means against the French penetration. The failure to echelon the attacks in depth allowed the enemy time to bring up reinforcements and organize new lines of defense. The failure to destroy German artillery enabled the Germans to support the eventual counter-attack with a devastating effect. As result of these failures, the French General staff revised its offensive approach.

The next French effort, the preparation for the Artois Offensives in May 1915, demonstrated a new conception of depth that magnified the scope of Pétain's limited attacks. The instruction note from the French Commander and Chief dated 16 April 1915 outlined the aim of the Artois offensive was not to successfully seize the hostile lines of trenches, but to "eject the enemy from his complete defensive system and to defeat him without giving him time to collect himself."[71] This approach incorporated attempted to harness depth through a rapid tempo that

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[68] Gudmundsson, *On Artillery,* 51.

[69] Bailey, *Field Artillery and Firepower,* 131.

[70] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918,* 11.

[71] Ibid., 38.

prevented the enemy from counterattacking or establishing new lines of defensive. Artillery would support this offensive through a systematic preparation on the whole position, then transition to a barrage. Additionally, as learned from the failed Perthes offensive, a portion of the French guns deployed well forward to conduct effective counterbattery. The French employed balloons and aerial reconnaissance to overcome the target location problem to attack the depth of the enemy artillery.[72] As for the infantry, the French selected objectives several kilometers beyond the fortified positions. In order to sustain an attack beyond the initial penetration, the divisions attacked along a narrow front of 1000 to 1800 meters with considerable depth, which enabled a sustained offensive for several days. [73] Despite this attempt to attack in depth, the first wave would have maximum density as outlined in the pre-war *Field Service Regulations of 1913,* one man per meter to achieve the initial penetration.[74] Despite this attempt to harness depth to dislodge the Germans from their fortifications, the French could not achieve a breakthrough. The failure of the Artois offensive provided a unique insight into the evolution of depth, because was the first operational attempt at depth in 1915.

The French learned the importance of surprise and experimented with a shorter barrage in an attempt to achieve greater depth through surprise. On 9 May 1915, the French attacked north Arras on a 15-kilometer front with five corps and 400 pieces of heavy artillery. The French surprised the Germans with an effective and massive artillery preparation in the center, which allowed two corps to make a deep penetration of four kilometers in less than an hour. However, an ineffective preparation prevented the southern corps from obtaining a foothold. Additionally,

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[72] George W Griner, *The Evolution of Field Artillery Tactics, Technique, and Organization On the Western Front During the World War* (Fort Leavenworth, KS: Command and General Staff College, 1933), 12.

[73] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 39.

[74] Ministres de la Guerre, *Décret Portant Règlement sur la Conduite des Grandes Unités* (Paris: Berger-Levrault, 1913), 47.

the French could not exploit the rapid and early success with reserves because the breach was too narrow. Furthermore, the inability to coordinate subsequent attacks among the center and southern portions of the front allowed the Germans to counter-attack on the most successful and forward French element.[75] This offensive proved that heavy artillery could create a penetration of the first trench, because the Germans defense weighted their strength in the first trench lines. Additionally, the inability to move reserves and artillery forward demonstrated a lack of depth from the French rear to the front line. [76] Despite this initial vulnerability, the Germans adapted during this offensive through the creation of a second fallback line of defense outside the range of French artillery. The French response came on 26 May 1915 in an amendment to the 16 April instruction. This order allocated a brigade size reserve within each corps to be deployed in communication trenches in order to continue the attack in depth and defeat the second stronger line.[77] Still, the French employed the same approach in the next campaigns despite the inability to neutralize the second line of defense.

In September during the Champagne and Artois Offensives, the French attempted two combined and simultaneous army sized attacks in concert with the 1st English army. The French attacked in Champagne along a thirty five kilometer front supported by 900 pieces of heavy artillery. In Artois, the French attempted to attack a long a length of nine kilometers with 250 heavy guns in support. In total, this offensive had fifty three infantry divisions, nine cavalry divisions, and 1,140 pieces of heavy artillery.[78] The Allies constructed elaborate communications trenches that extended five kilometers to the rear, which were to facilitate the employment of

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[75] Gudmundsson, *On Artillery*, 52.

[76] Peter Hart, *The Great War: A Combat History of the First World War* (New York: Oxford University Press, 2013), 152.

[77] Ian Malcolm Brown, *British Logistics On the Western Front, 1914-1919* (Westport, CT: Praeger, 1998), 89.

[78] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 50.

reserves to achieve depth. Additionally, for the first time, the Allies concentrated additional airpower to achieve air superiority and support the counter-battery effort. However, the massive concentration and preparation forfeited the element of surprise. The artillery registered their guns six days prior to the attack and the preparation fires lasted for 75 hours in Champagne and five days in Artois.[79] Therefore, the day prior to the attack, the Germans withdrew their artillery to the second line of defense. On 25 September 1915, the day of the attack, the French and English secured the first line of defense at Champagne and Artois. However, at the second line of defense, the attack broke down because the artillery and reserves could not displace and move forward to support the second attack.[80] Additionally, the French method of prescribed attacks to achieve a combined effect broke down after the initial assault. The further the French moved through the depth of the German lines of defense, then the greater the inability to command and control its formation. This defense-in-depth changed the character of warfare on the Western Front. Therefore, the French would require new methods on how to sustain an attack in depth.

Overall, the most important lesson for the French from the campaign was the inextricable link among time, preparation, and surprise to achieve operational depth. Heavy artillery enabled the initial penetration along a narrow sector. However, once the initial bombardment occurred, time became the critical commodity for the French and Germans. The Germans would race reinforcements to the point of penetration and the French preparation dictated the speed and concentration to which fresh troops could continue the attack. Surprise would provide additional time for the French to move deeper and reach their goal of open warfare. However, the French needed to weigh the importance of surprise with the effectiveness of the artillery bombardment. The French solution to this problem would define the next phase of the war, destruction.

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[79] Griner, *The Evolution of Field Artillery Tactics, Technique, and Organization On the Western Front During the World War*, 13.

[80] Bailey, *Field Artillery and Firepower*, 131.

1915 Stabilization and Experimentation: The British

In 1915, the British Expeditionary Force displayed an experimental theoretical foundation defined by "equipment shortages, an administrative muddle, and universal unpreparedness."[81] The British needed to support the French offensives until enough guns and ammunition reached the trenches before the British could develop a more independent approach.[82] With limited resources and capability, the British did not abandon their pre-war theoretical foundations, but modified it with the French concept of the limited attack. The biggest change was the importance of the artillery fire plan, in particular its precise scheduling and concentration.[83] The infantry's primary method remained a series of successive linear waves moving forward by alternate rushes covered by fire where possible. Rearward units would either follow on to consolidate, or leapfrog to the more forward units at predetermined intervals to continue the attack.[84] The British gradually integrated aircraft, smoke, gas, trench mortars, and signal into pre-existing method of the attack. Therefore, limited resources characterized the British offensives of 1915, which resulted in in experimentations that grafted new techniques and material into their existing doctrine.

The first British offensive of the year, Neuve Chappelle, demonstrated a mechanistic concept of depth that incorporated the French lessons on the importance of surprise and concentrated firepower. In March 1915, the British attacked to penetrate the German line at Neuve Chapelle from 10-12 March 1915. Due to the limited available heavy artillery, the British

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[81] Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18*, 52.

[82] Bidwell and Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945*, 70.

[83] Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18*, 53.

[84] J.C. Dunn, *The War the Infantry Knew 1914-1919* (London: King & Son, 1938), 159.

initial attack consisted of only three brigades supported by 350 heavy guns.[85] Due to the lessons of the French, the British limited the preparation to only 55 minutes in order to achieve surprise.[86] Additionally, the British achieved precision through spreading out the registration of its guns over a three weeks and integration of aerial photography. The British managed to penetrate nearly two kilometers into German occupied trenches. However, the British concentrated their artillery on obstacles rather than the German troops. Therefore, the Germans managed to recover, establish a new line of defense, and delay the British long enough to counter-attack.[87] The British also introduced the 'lifting barrage' that focused fires along the trench closest to the attacking element.[88] This new method provided greater flexibility and tactical depth than the 'creeping barrage' because it was not set on preordained and arbitrary rates of advance. Despite this innovation, the inability to destroy German artillery rendered the attack ineffective after several hours. Overall, the British erroneously believed the failure laid in the ability to use artillery to reduce the obstacles rather than the German defenders. Therefore, this led to a greater emphasis on longer duration bombardments and a willful sacrifice of surprise.

In September 1915, the Battle of Loos, as a part of the French Champagne campaign, demonstrated the importance of surprise over concentrated firepower to achieve a tactical penetration in depth. After Neuve Chappelle, the Germans constructed more complex and deeper defenses. In order to reduce theses defenses, the British bombarded lasted for four days.[89] Additionally, rather than a narrow frontage, the British utilized a wide front that led to dispersed artillery support, which was mitigated through the employment of gas. General Haig attempted to

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[85] Bailey, ed., *Field Artillery and Fire Power*, 131.

[86] Griner, *The Evolution of Field Artillery Tactics, Technique, and Organization On the Western Front During the World War*, 12.

[87] Bailey, ed., *Field Artillery and Fire Power*, 132.

[88] Ibid.

[89] Bidwell and Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945*, 77.

achieve depth through surprise, which relied on the effect of gas. However, the technology was unreliable and relied heavily on the weather. As for the battle, despite only partial early success, IV Corps seized the initial objective Loos and Hill 70, the Germans counter-attacked and routed the British. The British believed that the inadequate artillery perpetration was the main reason for the failure. The British decided that 'hurricane bombardments' from guns firing at very high rates as the only way to achieve a breakthrough.[90] Therefore, the next British effort would be come until the British resolved the lack of heavy artillery and ammunition.

By the end of 1915, the destruction of German defenses through massed heavy artillery became the all-consuming pre-requisite to the British mechanical concept of depth. Prior to World War I, infantry mobility functioned as the way to achieve surprise, but the British experimentation at Neuvelle Chapelle demonstrated that firepower offered a new method. Despite the hard-learned lessons of the French at Perthes and the British at Loos on the importance of surprise, the British deliberately abandoned surprise for massed concentration to achieve destruction. Field Marshall Haig, the new British Expeditionary Forces' commander after the failure at Loos, would not conform tactics to technical limitations of new systems such as artillery and gas. Additionally, Haig did not understand the tactical difference between a breakthrough battle and the series of battles of attrition in which he engaged by choice or necessity.[91] The British needed to find a way to get through the third and last of defense when could not even range the second or third line with their artillery.[92] Additionally, the question remained on how to exploit success with the use of reserves. With these shortcomings, the British would attempt to achieve depth through massive destruction in a single decisive battle rather than surprise or

[90] Ibid., 79.

[91] Bidwell and Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945*, 79.

[92] Tim Travers, *The Killing Ground: The British Army, the Western Front and the Emergence of Modern War* (Barnsley, South Yorkshire: Pen and Sword Military, 2009), 128.

arrangement of multiple tactical actions against the German defenders. This operational approach would have tremendous consequences at the battle of the Somme when the British had their desired heavy guns and ammunition.

1915 Stabilization and Experimentation: The Germans

German military theory of depth at the start of 1915 dictated that the battle must be won in the first trench, which evolved as result of Allied attempts to create a breakthrough on the Western Front. The German army haphazardly organized a defensive system over the winter of 1914, but the main positions lacked depth and could not withstand concentrated heavy artillery.[93] The demands of the Eastern front denied any possibility of a major German offensive in the West in 1915, which compounded the problem further. The Germans decided to utilize a rigid first line defense at all cost. Any lost ground required an immediate counter-attack.[94] Therefore, the German military theory in early 1915 relied on the principle of "*Halten, was zu halten ist*" meaning "Hold on to whatever can be held."[95] General Falkenhayn, the new Chief of the General Staff of the German Army, issued two memorandums that outlined his defensive concept to the armies of the Western Front on 7 and 25 January in 1915. Within these notes, Falkenhayn outlined that the existing line needed fortification and organization for a prolonged time to allow the maximum number of troop transfers from the Western to the Russian front. The composition of a foremost line was the most important element, because it would be the line of resistance. However, the note of the 25th did add the provision to create a rearward trench outside of artillery range as insurance against an allied breakthrough.[96] This would create a bend in the German line

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[93] Robert T. Foley, *German Strategy and the Path to Verdun* (Cambridge, MA: Cambridge University Press, 2007), 163.

[94] G. C. Wynne, *If Germany Attacks: the Battle in Depth in the West* (Westport, CT: Praeger, 1976), 16.

[95] Lupfer, *The Dynamics of Doctrine: the Changes in German Tactical Doctrine During the First World War*, 3.

[96] Martin Samuels, *Doctrine and Dogma: German and British Infantry Tactics in the First World War* (New York: Greenwood, 1992), 78.

rather than a collapse. However, due to the colossal undertaking of creating another layer to a vast array of trench network and the intransigence of German commanders such as the Crown Prince Rupprecht of Bavaria, this tepid employment of depth largely went unheeded.

The lack of depth of the German defenses throughout the winter and spring of 1915 left the front line vulnerable to heavy artillery, which nearly resulted in a series of Allied breakthroughs. The concentration of the preponderance of German forces in the first line of defense enabled massed French and British artillery to strike throughout the shallow operational depth. However, the French inability to achieve surprise and neutralize dispersed artillery enabled the reinforcement and successful counterattack at the Battle of Perthes in February 1915. At the battle of Neuvelle Chappel, the British achieved surprise, which allowed them to extend into the depth of the German first line of defense.

The British and French spring offenses in 1915 demonstrated the vulnerability of the rigid line defense to heavy artillery due to a lack of depth. At Neuve Chapelle on 10 March, the German arrayed their defense 2,500 meters deep. The front line held half of the defenders. One kilometer behind the front line, a series of concrete machinegun posts covered the intervening ground. However, the two lines did not have protected communications trenches. The German commander, Crown Prince Rupprecht, believed that a fallback position would result in a half-hearted attempt to defend the first line. The bulk of the artillery resided 1,500 meters behind the strong points. Additionally, an incomplete artillery reserve existed 2,500 meters further back. The Germans had billeted reserves 8,500 meters behind the front line and a general reserve would take 24 hours to arrive to the front. However, despite the appearance of depth, the German trench stood only 100 meters away from British. Therefore, the German defenders could not conceal their disposition from direct observation. Additionally, the strong points could be targeted

through aerial photography, but were difficult to spot from ground observation. [97] Overall, the German's defense remained highly vulnerable to concentrated heavy artillery. Therefore, the British attacked after a short, but intense, bombardment that killed or neutralized the forward trench.[98] The short preparation did not destroy all the machineguns, which limited the British advance to the second line. The British could not carry the attack through the depth of the second line due to poor infantry-artillery coordination and use of reserves.[99] On the second day, the German counter-attack failed to dislodge the British from the first line, but the danger of a breakthrough passed.[100] However, the near breakthroughs of the French and British offensives created the catalyst towards greater operational depth to mitigate the danger of concentrated heavy artillery.

This near breakthrough imparted important lessons that would lead to the development of a new defensive combined infantry and artillery doctrine.[101] The rigid line defense sought to create a broad field of fire through massed infantry on the front line, which was consequently highly vulnerable to concentrated artillery. Additionally, a forward concentration limited the forces available to conduct a counter-attack. This system resulted in a linear and inflexible method of defense. The experiences of late 1914 to early 1915 demonstrated that easily concealed machineguns provided the same firepower as massed infantry. Therefore, a thin line of machineguns protected by fewer infantry would allow the Germans to hold the bulk of the counter-attack force outside the range of artillery. Lastly, the Germans emphasized the

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[97] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 162.

[98] Martin Samuels, *Doctrine and Dogma: German and British Infantry Tactics in the First World War* (New York: Greenwood, 1992), 76.

[99] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 163.

[100] Wynne, *If Germany Attacks: the Battle in Depth in the West*, 1976, 40.

[101] Foley, *German Strategy and the Path to Verdun*, 165.

importance of camouflage to protect strong points. Firepower provided to the fundamental agent of change for the Germans in their concept of depth. The vulnerability to heavy artillery led to a greater dispersion and reliance on concealed machineguns. Additionally, the Germans organized a theater level artillery reserve that moved to threatened points.[102] This combined fire of organic and reinforcing artillery would be critical to destroying the infantry as they left their trenches, cutting them off from their rearward communication, and defeat the enemy artillery. This shift in artillery doctrine extended the depth of the Germans while denying the same to the attacking French and British. These lessons would result in a shallower, but more flexible defense that served as the foundation of German defensive doctrine in late 1915.

In the fall of 1915, the British and French Champagne Offensive demonstrated a German initial attempt to employ greater tactical depth to deal with massed heavy artillery. Prior to the battle, the shift in the concept of depth is not a factor of greater distance, but the disposition of combat power to extend operations in time, space, and purpose. The defense at Champagne consisted of a series of lines that extended back eight kilometers. The German's first line of defense centered on a crest line and functioned as a lightly held outpost zone rather than a concentrated redoubt. Behind this line on the reverse slope was the First Position, which consisted of several trench lines. This series of trenches contained primarily machinegun, artillery observers, larger direct fire guns, relatively few infantry, and a small detachment of field guns. This zone extended 2,500 meters until it reached the 1st Rearward Position. This position sat on the front slope of the next ridgeline and contained the local reserves and additional artillery observers. 2,500 meters further to the rear laid the 2nd Rearward Position on a reverse slope and a small covering force for the general reserve.[103] This change rendered enemy artillery less effective through greater dispersion and depth. Secondly, the greater dispersion allowed for

[102] Foley, *German Strategy and the Path to Verdun*, 165.

[103] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 168.

greater camouflage, which further protected the Germans from heavy artillery. The substitution of infantry firepower for machinegun firepower allowed the initial defense to remain strong and freed additional infantry to add additional weight to the counterthrust. This increased depth left the French incapable of neutralizing the 2nd Rearward Position and thus unable to hold out against a determined counterattack.

Therefore, the German concept of depth demonstrated the greatest shift from the pre-war theory and doctrine among all the combatants on the Western front. Prior to the war, the Germans placed a greater emphasis on firepower over the French and British. The Germans re-arranged tactical dispositions to mitigate the impact of heavy artillery and utilized firepower to enable the decisive element, the counter-attack. This concept of depth remained rooted in the tactical domain, because the desire to hold ground at all costs did not change. This doctrine only allowed the Germans to absorb Allied attacks, contain them, and defeat them with spirited counter-attacks. In essence, the Germans utilized tactical depth to increase the resilience of its formation. This concept did not extend to the operational, because it was not linked to a series of distributed operations. The Germans could not exploit this form of defense at the operational level, because it remained too weak to wage an extensive counter-offensive. General Falkenhayn sought to develop a synthesis from the lessons on the Eastern and Western fronts to develop a new approach the following year.

1915 Stabilization and Experimentation: Conclusion

At the end of 1915, a year of trial and error led to a multifaceted approach that moved towards operational depth on the Western front. The Allied offensives experimented with a combination of surprise, logistical preparation, and concentrated artillery to achieve a greater operational depth. The Germans, in response, reordered their operational approach to achieve greater tactical depth in order to ensure that their rigid line bent, but did not break. All sides developed technical solutions to improve target location while achieving surprise. In particular, the selective use of registration, predictive firing techniques using meteorological data, sound-

ranging stations, and integration of aerial photography led to improved counter-battery. As 1916 began, artillery would be increasingly vulnerable. Additionally, the logistical buildup needed to achieve the desired level of destruction would have a further impact on depth.[104] This would require an increased attention to centralized fire control at the cost of integration with the infantry. The British in particular would not commit to a large-scale infantry assault until it thought it could win the artillery duel.[105] Despite technical advancements and tactical experimentations that harnessed depth, stalemate dominated the Western Front.

[104] Bidwell and Graham, *Fire-Power: British Army Weapons and Theories of War, 1904-1945*, 63.

[105] Bailey, ed., *Field Artillery and Fire Power*, 133.

Section 3
1916-1917 The Failure of Destruction

After the failed experiments of 1915, the British and French placed their faith on the 'Weight of Metal' to be the chief arm of offense while the Germans continued to place their emphasis on the immediate counter-attack to regain lost ground.[106] The failure of the French offensives led General Falkenhayn to reach a conclusion that France and its army neared the "end of its strength."[107] The Allied leaders decided on 29 December 1915 that a massive Anglo-French offensive of sixty five divisions along a seventy kilometer front would overwhelm the Germans.[108] Yet, this movement towards operational depth required a solution to the tactical problem of the initial penetration followed by subsequent attacks to defeat the reserves. The British and French's approach required a massive bombardment to "crush all resistance, and that it would be necessary for the infantry only to march forward and take possession."[109] The tactics of destruction needed depth due to the vast requirement for logistical support, particularly in artillery ammunition. The lessons of the first years of war dictated that the line on which artillery is to fight the conclusive action forms the framework for every major engagement. The massive employment of artillery required undamaged roads and railways. From 1916 onwards, the infantry attack became possible only with greater operational depth provided by artillery and logistical preparation. Most importantly, the challenge and response dynamic of this massed concentration of heavy artillery among the Allied and Central powers led to a movement towards operational depth.

1916-1917 The Failure of Destruction: The French

[106] Wynne, *If Germany Attacks: the Battle in Depth in the West*, 100.

[107] Foley, *German Strategy and the Path to Verdun*, 179.

[108] Ibid.

[109] Bailey, ed., *Field Artillery and Fire Power*, 129.

From late 1915 through early 1917, the French operational approach encompassed huge offensives with objectives deep in the German rear. In order to achieve this penetration, the French concentrated massive amounts of men and firepower. Obstacles and trenches delayed the forward movement of the infantry and artillery. The displacement of artillery required adding intervals or phasing to the attack. However, the German ability to reinforce an area by rail and roads enabled an overmatch against the exhausted attacking force who lacked artillery support. The French contended with German reserves through multiple attacks, usually on a successive basis, across a broad front.[110] This operational depth required a careful arrangement of attacks that compelled a defender to commit their reserves piecemeal. Yet, the massive artillery preparation denied the attack the benefit of surprise, a key requisite to win the race against German reserves. The long preparation indicated where the Germans needed to shift reserves.[111] The German offensive against Verdun interrupted the employment of this destruction tactic, but the counter-offensive would see its effective use.

The Germans achieved tactical surprise over the French through the employment of heavy artillery at Verdun, but deliberately chose to not breakthrough. The carefully camouflaged preparation and aerial reconnaissance enabled the German bombardment to range the entire tactical depth of the French defenses at Verdun. After the assault, the Germans continued to fire to the rear and on the flanks of the French.[112] After the initial shock, General Pétain ensured the French army could withstand the attritional struggle. The limited and narrow German attacks enabled Pétain to utilize reserves to block penetrations. Additionally, Pétain massed a quantity of heavy artillery pieces, 1,200, to obtain operational depth through fire support. A large scale

[110] Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940,* 86.

[111] Wynne, *If Germany Attacks: the Battle in Depth in the West*, 59.

[112] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918,* 72.

counterbattery effort in conjunction with aerial photography on the largest scale to that point provided operational results. General Robert Nivelle, an artillery officer who rose to the ranks during the Verdun counter-offensive, developed a tactical template, which would constrain the operational depth of the French in the disastrous offensives of 1917.

General Robert Nivelle employed his refined tactical "formula" that failed in the 1915 offensives to recapture critical Verdun fortifications.[113] Under his direction on 24 October 1916, after a four-day artillery preparation and exhaustive rehearsals, seven divisions attacked along a seven kilometer front, which penetrated three kilometers and captured the key terrain of Fort Douaumont. The French repeated this method on 2 November and recaptured Fort Vaux. These limited but successful attacks utilized more than one million rounds of artillery against German positions before commencing a rolling barrage in front of attacking infantry.[114] After this success, Nivelle tried to apply this tactical formula to the operational level of war, which reflected a methodical concept of operational depth.

In the Spring of 1917, the Nivelle attempted to magnify his methodical approach to the operational level to achieve a breakthrough to end the war along the Aisne River between Reims and Soissons. Nivelle's approach, instead of being a solution to the tactical problem, became an end itself.[115] Nivelle employed large amounts of heavy artillery to obliterate the entire tactical depth of the Germans. This approach relied on a massive barrage on each line of defense simultaneously. The infantry would be supported by a single rolling barrage in order to capture the heights of Chemin des Dames north of the Aisine in 24 to 48 hours.[116] The French sought

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[113] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918,* 73.

[114] Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940*, 83.

[115] Lupfer, *Dynamics of Doctrine: The Changes in Tactical Doctrine During the First World War*, 33.

[116] Doughty, *Historical Perspectives of the Operational Art: French Operational Art 1888-1940,* 84.

operational depth through leaping frogging large quantities of artillery and ammunition forward. The achievement of depth through firepower came at a tremendous cost in mobility, flexibility, and surprise. The commander decided to continue the offensive despite the compromise of the plan. Nivelle amassed 1,400,000 men in fifty two divisions with over 1,650 mortars and over 3,400 pieces of artillery.[117] Yet, when the French infantry assaulted on 16 April 1917, they met disastrous results. With knowledge of the plan, the Germans defeated each attack with concentrated artillery and counter-attacks. Nivelle's method could not be expanded to a larger scale to attack through the Germans' operational depth. After a week of fighting, the French suffered over 117,000 casualties and the morale of the French army was sapped, which contributed to the mutinies of 1917.[118] As a result of the failed offensive, Pétain replaced Nivelle and immediately set about ending the mutinies and restoring the French fighting spirit.

Pétain abandoned the deep objectives that characterized French offensives and instead emphasized limited objectives. In May 1917, Pétain published Directive Number 1, which outlined his new operational approach: "Instead of great attacks in depth with distant objectives, it is preferable to conduct attacks with limited objectives, unleashed quickly on a front as large as permitted by the number and caliber of available artillery."[119] This method emphasized the use of artillery over infantry to rebuild the morale of the French army. Secondly, the attack must be preceded by surprise through attacking quiet sectors. Additionally, the attack must be applied to several parts of the front which the Germans cannot abandon. Once the reserves are fixed, the decisive limited attack can take place. This memorandum demonstrated an operational depth designed to solve the French dilemma of recent mutinies, primacy of artillery, and lack of an assailable flank. Pétain used simultaneous limited attacks to disrupt the decision cycle of the

[117] Ibid.

[118] Robert A. Doughty, *Pyrrhic Victory: French Strategy and Operations in the Great War* (Cambridge, MA: Belknap Press, 2008), 340.

[119] Ibid.

German army, most importantly its ability to send reserves to a threatened front. Pétain balanced the tempo of his offensives to limited attacks that husbanded French infantry and defeat the eventual German counter-attack. The depth of the attack remained tied to distance that artillery could support it and not extend beyond it. [120] The matured concept of operational depth provided a vital time for American reinforcements to arrive in significant numbers and shift the strategic balance of the war.

1916-1917 The Failure of Destruction: The British

The preparation for the Somme Offensive mirrored the French concept of operational depth, but the British displayed a willingness to experiment with new tactics to achieve it. For commander Douglas Haig, the problem revolved around one question: how to apply traditional principles to a new and puzzling form of warfare. The British operational approach incorporated the Napoleonic advance guard method of engaging the enemy along a broad front, of a hundred miles or more, then after five or six days, wear down the operational reserve, attack by surprise and break through where the enemy appeared weak. [121] Yet, as result of the Verdun offensive, the British abandoned the preparatory attack to wear down the reserves from the original three act plan.[122] The French could only provide a dozen divisions rather than the originally promised sixty five.[123] Without the required forces, Haig overruled Rawlinson, the army commander who argued for a methodical attack, and instead ordered Fourth Army's objectives deep within the German defensive system.[124] Yet, Rawlinson utilized a methodical firepower centric approach similar to

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[120] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918,* 109.

[121] Travers, *The Killing Ground: The British Army, the Western Front and the Emergence of Modern War,* 127.

[122] George A. B. Dewar, *Sir Douglas Haig's Command, December 19, 1915, to November 11, 1918* (Boston: Houghton Mifflin Company, 1923), 100.

[123] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918, 126.*

[124] Ibid., 127.

Nivelle to create the initial penetration. The confusion between Rawlinson and Haig's approaches created a rigidly scheduled, inflexible use of firepower that forfeited surprise. The mismatched approaches combined with the inability to wear down the reserve codified the lack of depth.

The British experience from the Somme reflected a flawed understanding of operational depth. The British unleashed 1,628,000 shells against seven German divisions over a period of a six-day artillery preparation. The initial attack consisted of seventeen British and French divisions followed by fifteen in reserve. [125] The massive and prolonged bombardment forfeited surprise, which provided the Germans time to move forces by rail from Verdun to the Somme. The bombardment sought to destroy all forces within artillery range, but enough Germans survived to inflict massive losses. Additionally, the untrained troops progressed in linear formations that increased the inflicted damage. Most importantly, British used a doctrine of fire-effect preceding movement, instead of harnessing a fire-effect combined with movement.[126] The British fought into positions where Germans could take a maximum toll with less resources. The policy of small, narrow front attacks enabled the Germans to concentrate their guns against a small number of British troops. [127] Therefore, the tactical failures contributed to inability to penetrate the German defensive system, but the lack of operational depth failed to set conditions for enable a breakthrough. The British failed to put the Germans into an operational dilemma. A series of limited attacks did not wear down the reserves, the French did not have enough resources to fix large scale German forces, and the British did not have the tactical and technical proficiency to penetrate German defenses. The difficulty to communicate denied the British the ability to increase the tempo by exploiting local success. This led to a movement towards operational depth through a more prescriptive approach.

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[125] Wynne, *If Germany Attacks The Battle in Depth in the West*, 106.

[126] Ibid., 117.

[127] Robin Prior and Trevor Wilson, *The Somme* (New Haven, CT: Yale University Press, 2006), 302.

In 1917, the British 'destruction' tactic reached its apex, but the continued lack of operational depth limited its impact. The British attack on the Vimy Ridge in April 1917 achieved its limited objectives through a methodical bounding of artillery and reserves to intermediate objectives. Again, the systematic two-week bombardment forfeited surprise. Furthermore, the demolished terrain and road system prevented the bounding of artillery and reserves forward. Additionally, the failure of the French in the Nivelle offensive lessened the impact of this limited success. The British continued this tactic through the summer. The major British attack that opened the Passchendaele offensive was delayed and disordered by the forward defenders and thrown out of the main battle zone by the *Eingrief* divisions.[128] The British adapted through strong attacks against the forward battle zone and elimination of the garrison, then rapidly prepared ground to defeat the clock-work German counter-attack. This shifted the balance of casualties in favor of the British and enabled them to wear down German reserves prior to a decisive attack. Despite the refined operational approach that favored attrition, the British could not continue at this pace. The British needed over 600,000 men to replace losses at the current rate. Additionally, the German victories in the east provided a numerical edge while the British started to understand operational depth.

The British 'bite and hold' method across a wide front demonstrated an improved conception of operational depth by the end of 1917, but it created an immense drain in men and material. General Erich Ludendorff concisely summarized the British approach: "The British believed in the efficacy of their skillfully worked out but rigid artillery barrage. This was to carry forward the infantry attack which advanced without the impetus of its own. The subordinate, and still more, the higher formation commanders ceased to have any further influence."[129] Without

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[128] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 194.

[129] War Department United States, *Survey of German Tactics 1918, Monograph No. 1* (Washington, DC: Government Printing Office, 1918), 44.

flexibility, the British operational approach could not penetrate the Germans' tactical depth without a prohibitive cost in casualties, 420,000 in the Somme and another 400,000 in the Passchendaele offensives. Yet, the British tactics of destruction demonstrated an operational depth extended into their own formations in the form of massive logistical support. However, this approach could only guarantee a local success of two to three kilometers in depth at the expense of surprise.[130] When the British designed the limited attacks designed to defeat the German counter-attacks, the British achieved their greatest success. In the later portions of the Somme campaign, the arrangement of limited attacks provided an operational advantage. Yet, the costly success at the Somme led to a German adoption of a new type of defense. The German's elastic defense in depth remained effective at preventing a break through. The tactics needed to defeat a breakthrough were not suitable to counter a limited attack. The tactics of destruction without operational depth remained a costly enterprise, which the British could not continue.

1916-1917 The Failure of Destruction: The Germans

The German army during the critical years of 1916 and 1917 demonstrated a shift towards operational depth. Throughout 1915 the German army defeated several major Allied offensives who nearly created a breakthrough with massed artillery. Additionally, a large portion of the army remained on the Russian front. These two strategic factors created the catalyst for change. First, the German High Command did not believe that an operational breakthrough could succeed.[131] Yet, after the failed French offensives, the German High Command believed that the French army and its people neared defeat.[132] General Falkenhayn envisioned a limited offensive to 'bleed white' the French army to the point of surrender, which would knock Britain's sword out of her hand and win the war. For the remainder of the Western Front, the Germany army

[130] Bailey, ed., *Field Artillery and Fire Power*, 141.

[131] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 70.

[132] Foley, *German Strategy and the Path to Verdun*, 186.

needed to remain on the strategic defensive. The Allied offensives provided the impetus to create an elastic defense in depth. This challenge and response dynamic between Germany's limited offensive at Verdun and massive Allied offensives led to an emergence of a unique form of operational depth.

Germany's limited offensive against Verdun demonstrated a unique approach that harnessed the lack of operational depth. Due to the inability to create a penetration and operational breakthrough, the General Staff Chief planned to force the French to attack strong German positions. In order to compel the *Entente* to attack, the Germans conducted a large scale attack on the heights that dominate the strategically vital fortress of Verdun.[133] Heavy artillery would be placed on the heights and threaten Verdun. When the French counterattacked to protect the fortress, they would need to attack stout German defensive positions. This approach reflected an incorporation of the operational lessons up until that point. The French and British proved that limited objectives could be achieved with minimal casualties when supported by heavy artillery. Additionally, the Allies demonstrated the difficulty, if not impossibility, of achieving an operational breakthrough. Therefore, the Germans selected an approach that maximized the inability to harness operational depth. The limited Verdun offensive would create a cauldron that supported an attritional strategy, because the Germans would have a strong defensive advantage. Despite a nested strategy and operational approach, the limited offensive did not break the back of the French army. Pétain instituted a series of methods that preserved combat power and morale. The Verdun offensive did considerable damage to the French army, but at too high a cost to the Germans. This failure led to Falkenhayn's dismissal and a shift in strategy back to the traditional German goal of a dictated peace through a large-scale annexation.[134] In order to create

[133] Foley, *German Strategy and the Path to Verdun*, 207.

[134] Ibid., 258.

the time for a victory on the Eastern Front, the German army would innovate towards operational depth.

The German experience during the Somme campaign created the catalyst to create an elastic defense in depth, which extended the German operational depth and denied the Allies from achieving a breakthrough through 1917. Despite the increase of greater tactical depth since the summer of 1915, the Germans remained fixed on the doctrine of the immediate counter-attack. Therefore, the Somme's defenses contained the fatal flaw of a densely held garrison on a forward slope.[135] On 1 July 1916, the German garrison bore the full brunt of the massive Allied artillery preparation. The German survivors inflicted massive casualties, but the army could not afford in a war of attrition without a greater conservation of their fighting strength.[136]

The elastic defense in depth extended the tactical depth of the German defense and harnessed operational depth to achieve strategic aims. Under the overall direction of General Ludendorff, the German army developed and implemented this new defensive from the autumn of 1916 to the spring of 1917. The key regulation, titled *The Principles of Command in Defensive Battle in Position Warfare,* provided general guidance for the conduct of the defense.[137] In essence, this doctrine allowed freedom of movement within a deep defensive zone. The doctrine relied on several factors that illustrated the importance of artillery. First, the new method required appropriate positions and artillery observation posts and rearward communications. This allowed the infantry to fight a mobile defense in a series of zones with the front divisions in an outpost zone and a battle zone supported by firepower. This differed from the static defense along a succession of trench lines.[138] This flexibility and economy of force enabled a designated reserve

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[135] Wynne, *If Germany Attacks: the Battle in Depth in the West*, 1976, 103.

[136] Lupfer, *Dynamics of Doctrine: The Changes in Tactical Doctrine During the First World War*, 8.

[137] Wynne, *If Germany Attacks: the Battle in Depth in the West*, 1976, 149.

[138] Ibid., 150.

division to conduct a synchronized counterattack. The counter-attack division served as an operational reserve 10-15 miles behind the front line divisions.[139] The doctrine allowed a greater freedom to concentrate fresh reserves from within its operational depth for the counterattack. This innovation preserved combat power through avoiding massed Allied firepower and retained an offensive character despite the strategic defense.

The battles of 1917 demonstrated Germany's doctrine harnessed operational depth, which denied the *Entente* powers an operational breakthrough while conserving combat power. On 16 April 1917, well concealed German strongpoints fired on the French from all directions, including the rear, as the French entered the battle zones.[140] Additionally, defensive positions provided excellent observation, and the German counterattacks were well coordinated with artillery. For the British, on 31 July 1917, the major attack in the Passchendaele offensive was delayed and disordered by forward defenders and thrown out of the main battle zone by the counter-attack divisions.[141] The British adapted to this tactic by conducting only a limited attack designed to defeat the counterattack. The balance of losses shifted back to the British. In October, the Germans tried to dislodge the British again, but they did not take into account the overwhelming firepower superiority. The Germans focus on obtaining a decisive tactical edge resulted in an operational blunder. The Germans responded to this shift not by a reversion to the rigid line defense, but by an intensification of its principles. The Germans modified the purpose of the forward zone of defense. In the event of a major attack the forward zone would move to the main battle zone. This extended the length of the no-man's land, which enabled German artillery

[139] Bradley J. Meyer, *Operational Art and the German Command System in World War I* (Columbus: Ohio State University, 1988), 381.

[140] Lupfer, *Dynamics of Doctrine: The Changes in Tactical Doctrine During the First World War*, 34.

[141] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 194.

to inflict damage on the infantry without fear of counter fire.[142] This continuous evolution pushed both the Allied and the Central powers towards greater operational depth.

1916-1917 The Failure of Destruction: Conclusion

At the end of 1917, French, British, and Germans exhibited the clear signatures for the evolution of operational depth. The French and British operational depth extended rearward in the form of logistical and artillery preparation. The tactically focused Germans sought to use greater tactical depth to mitigate the power of Allied bombardment and operational depth to employ reserves in a decisive counter-attack. Artillery served as the main catalyst for change towards operational depth. The lethality of massed artillery provided the means to create the penetration needed for an operational breakthrough, which required enormous preparation. However, this preparation created new problems and a divorce between the infantry and artillery. The long duration of preparation and rigid timescales employed by the Allies shackled flexibility and denied surprise. This ineffectiveness denied the *Entente* powers from attacking throughout the operational depth of the German defenses up until this point. The Germans moved towards greater operational depth through tactical excellence. The elastic defense in depth contained elements of operational depth that would play a key role in the 1918 offensives. In particular, the importance of synchronization among artillery and infantry and the use of operational reserves.

[142] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 196.

Section 4
Neutralization and the Threshold of Operational Depth

After four years of conflict, the German army prepared for the climactic offensives to end the war. As a result of the hard fought campaigns of 1916-1917, the British and French had exhausted their offensive potential and shifted to the defense. Additionally, the United States entered the war in early April 1917 and sent over one million men to France in support of the Allies. The exhausted Russians signed the Brest-Litovsk treaty, which enabled the Germans to transfer an additional thirty-five combat divisions and over 1,000 heavy guns on the Western Front.[143] However, the German army needed to use this eighteen division superiority to defeat the Allied powers before the United States could bring enough manpower to tip the balance. This confluence of strategic factors had a decisive impact on evolution of operational depth.

1918 Neutralization and the Threshold of Operational Depth: The Germans

From the fall of 1917, General Ludendorff prepared Germany for open warfare on the Western Front, which attempted to achieve operational depth through tactical excellence. General Ludendorff outlined the task ahead by stating in the fall of 1917, "the situation in which the Army found itself, demanded an offensive which should produce a rapid decision."[144] Ludendorff saw the British as the most dangerous of the Allies. Therefore, the British became the focal point of the offensive. This decisive campaign required not only a large amount of materials and troops, but a new doctrine and rigorous training. Along with the shift in divisions and materials from East to West, key leaders brought new ideas, such as the artillery pioneer Colonel Georg Bruchmuller. Despite the lack of offensive experience in the West, the Germans learned from the Allied failures the importance of surprise, concentrated artillery fire in depth before an assault, and the

[143] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918,* 130.

[144] Ibid.

requirement for combined arms cooperation.[145] On 1 January 1918, the German High Command published the doctrine that incorporated these lessons that demonstrated operational depth.

Der Angriff im Stellungskrieg, or *the Attack in Position Warfare*, was the doctrinal framework for the spring offensives, which sought to achieve an operational breakthrough through infiltration tactics, neutralization fires, and decentralized control. This doctrine noted that the breakthrough was the ultimate goal of the penetration.[146] This required deep and rapid penetrations into enemy defenses, but not the methodical destruction attempted by the Allies. First, the preparation for the attack required operational surprise through careful camouflage, operational secrecy, night movements, and violence of the artillery preparation.[147] Col. Georg Bruckmuller's artillery preparation consisted of a short but powerful barrage designated to isolate, demoralize, and dislocate enemy defenders. [148] During the execution, the first echelon of assault troops bypassed centers of resistance. The final aspect of German infiltration tactics sought to disorganize the enemy rear. Lastly, deep fires disrupted communication and command centers.[149] Therefore, the Germans created a framework efficient enough to overcome the tactical problem of a penetration to achieve operational depth. At the operational level, the attack formation capitalized on a breakthrough by remaining echeloned in depth to cover the flanks and confront counterattacks.[150] This required the reinforcement of the infantry's firepower so it could continue the action without artillery. However, this system contained a fatal flaw. The state of the

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[145] Lupfer, *Dynamics of Doctrine: The Changes in Tactical Doctrine During the First World War*, 38.

[146] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 242.

[147] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918*, 131.

[148] Gudmundsson, *On Artillery*, 94.

[149] Jonathan M. House, *Toward Combined Arms Warfare: a Survey of 20th-Century Tactics, Doctrine, and Organization* (Lawrence: University Press of Kansas, 2001), 55.

[150] Ibid.

German economy and lack of emphasis on logistics created an 'Achilles Heel' for a system that required depth. Additionally, the regulation made no note of cavalry as an arm of exploitation of success after a rupture of the front.[151]

During the conduct of the major offensives of the spring of 1918, German infiltration tactics led to an operational breakthrough that ultimately failed due to a lack of logistics. The MICHAEL offensive sought to strike at the junction of the British and French armies in Flanders. With the British cut off from the French, they could be defeated in detail.[152] This attack along a 50-mile front between Arras and Amiens consisted of three German armies. Second Army was designated as the main effort. The mission of the Eighteenth Army was to isolate the British by preventing the French from reinforcing their allies. The Seventeenth Army was to deny the British the ability to move reinforcements to the center from the north. The preparation for the Picardie Offensive centered on elaborate deception measures that convinced the Allies that the main attack would be delivered in the French sector. The preliminary bombardment lasted only five hours supported by 8,067 guns, the largest concentration of artillery to date. The sound could be heard as far away as London.[153] The subsequent infantry assaulted penetrated beyond the entire tactical depth of the British defense. The Germans retained the momentum through echeloning fresh troops, while the British tended to fight set-piece battles and therefore could not cope with the German tempo. A decentralized command structure allowed commanders to continue successfully with limited information reaching senior commanders. Despite the tactical success, the Germans could not achieve a strategic breakthrough. Transportation difficulties

[151] Lucas, *The Evolution of Tactical Ideas in France and Germany during the War of 1914-1918,* 136.

[152] David T. Zabecki, *Steel Wind: Colonel Georg Bruchmüller and the Birth of Modern Artillery* (Westport, CT: Praeger, 1994), 67.

[153] Ibid., 72.

plagued German operations.[154] The inability to move artillery and ammunition forward slowed the operational tempo, which shackled the potential of the breakthrough. Additionally, the breakdown of discipline among German troops slowed the momentum when widespread looting occurred in Allied depots.[155] Additionally, the German army did not have the ability to interdict French and British operational reserves who utilized motor transport and the dense railway system. This pattern continued for another four offensives throughout the spring of 1918. During these offensives, Germany lost the best of its army while the Allies continued to increase in strength. By August 1918, despite impressive tactical victories, the Germans were exhausted. The Allies, with superior resources, seized the initiative and defeated the German army. From the combination of German success and failures, a clear conception of the origin of operational depth can be discerned.

The German offensives of 1918 demonstrated that operational depth required surprise, combined arms cooperation, decentralized control, logistical depth, and the ability to interdict operational reserves. The German predilection for tactical excellence, while commendable, meant nothing without adequate support in depth. The principles within German doctrine did orient a major shift to achieve its strategic aims. The emphasis on surprise provided additional time to mass echeloned assault formations to provide continuous pressure on British forces. Bruchmüller's neutralization fire support tactics enabled the Germans to shock the entire tactical depth, which enabled the operational penetration. The Germans maintained the speed of the advance through decentralized control that stressed maximum flexibility. Additionally, the Germans provided a vital lesson that without adequate logistical support, tactical excellence will lead to culmination. The logistical failure of *Operation Michael* repeated the same mistakes of the

[154] Lupfer, *Dynamics of Doctrine: The Changes in Tactical Doctrine During the First World War*, 53.

[155] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 269.

Schlieffen Plan. Operational depth cannot be achieved without the rearward sustainment and communication. Lastly, the lack of a mobile exploitation arm such as armor or cavalry denied the Germans the ability to stop the Allied reserves.

1918 Neutralization and the Threshold of Operational Depth: The British

In the last year of the Great War, the British army sought to achieve operational depth through technical innovation, a selective adoption of German methods, and firepower. The first massed employment of armor at the Battle of Cambrai achieved an impressive local success, but a German counter-attack reversed it. By the fourth Christmas of the War, the British Expeditionary Force became exhausted through its multiple attempts to achieve a breakthrough. From January and February of 1918, the British armies desperately tried to organize their defenses in both depth and breadth, but suffered from an acute manpower crisis.[156] The Northern Front could adequately maintain operational reserves, but the Center Front remained dangerously exposed. The British adopted portions of the German doctrine, but without the clear emphasis on the synchronized and deliberate counter-attack.[157] During this transition, the Germans managed to penetrate 40 miles through the British front and capture over 1,000 square miles of ground.[158]

The British concept of operational depth prior to the 1918 Spring Offensives led to a series of severe tactical defeats and a near operational collapse. After the bloody stalemate of Passchendaele, the British adopted elements of German doctrine without a holistic understanding, particularly in regards to the operational reserve. The United Kingdom's *Official History* attributed defeat to the lack of time to inculcate the doctrine, which resulted in an overcrowded forward defense.[159] In addition, the acute manpower crisis greatly reduced the military labor able

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[156] Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18*, 91.

[157] J.E. Edmonds, *History of the War Military Operations France and Belgium 1918, Volume I: the German Offensive 1918* (London, UK: Macmillan, 1935), 256.

[158] Travers, *Killing Ground*, 220.

[159] Ibid.

to prepare defensives in depth.[160] Lastly, the British could not place the same emphasis as the Germans on training for this new type of defense. Most importantly, the manpower constraints left the British incapable of forming large reserves. Therefore, the British doctrinal framework resulted in an operational level delaying action due to a lack of emphasis and capability to employ an operational reserve. As a result of this concept of depth, the Germans achieved a major tactical success against the 5th Army. The forward zone disintegrated and the main battle zone fought a short and passive battle. If the counterthrust had been an essential part of the defensive plan, the forward zone could have held out longer.[161] After the defeat on 21 March 1918, the British could not cope with the tempo of the German advance. The British struggled to maintain their operational depth in retreat just as the Germans struggled to continue the advance. The artillery often failed to keep in touch with the infantry and lateral communications between formations tended to break down every time there was a move.[162] The British did have adequate logistical support throughout the retreat, which prevented a complete collapse.[163] The British checked the German offensives ten miles short of their objective, Amiens. However, the German logistical inadequacy played just as large of a role in stopping the offensive as the British troops. Despite German initial tactical successes, Ludendorff's offensives stalled by Midsummer. The British counter-offensive in concert with the French demonstrated conceptual progress towards operational depth.

The Amiens Offensive on 8 August 1918 demonstrated a matured concept of operational depth through its employment of cavalry, surprise, and its prompt cancelation once it lost steam.

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[160] Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18*, 90.

[161] Samuels, *Command or Control? Command, Training, and Tactics in the British and German Armies, 1888-1918*, 267.

[162] Griffith, *Battle Tactics of the Western Front: The British Army`s Art of Attack, 1916-18*, 92.

[163] Ian Malcolm Brown, *British Logistics On the Western Front, 1914-1919* (Westport, CT: Praeger, 1998), 179.

The British learned from the German offensives the importance of surprise and therefore eliminated the preliminary bombardment.[164] Additionally, the British secretly amassed four Canadian divisions with 580 tanks. The British achieved the shock with a hurricane bombardment followed by a tank and infantry assault. After the British secured the initial trench, armored cars and cavalry interdicted German reserves. Most importantly, when the British lost the momentum they called off the offensive. This demonstrated a more judicious use of combat power, because prior offensives continued despite needless losses. The Battle of Amiens demonstrated the potential shock value of massed armor to create the initial penetration rather than relying on fire support alone. After the success in August, the British artillery focused on deeper targets, which demonstrated a movement towards operational depth.

After the success of August 1918, British artillery focused on deep fires against the Hindenburg Line to achieve operational depth. The objective of the Hundred Days Offensive was the lateral communications into France. This campaign served as a massive double envelopment achieved by leapfrogging a series of intermediate objectives along the entire Western Front. Since the German army suffered an acute manpower crisis, the British did not need to rely on strategic surprise.[165] Air superiority and technical improvements in target location enabled the British to achieve operational depth through long range heavy artillery. This remained possible because of a general offensive along the entire Western Front, which enabled operational depth. This depth derived from the long distance bombardment and the inability to shift German reserves. The bite and hold method enabled the British to use deeper firepower to chip away and exhaust the German army to defeat. Fewer resources became devoted to the close battle as opposed to the deeper battle, in particular with counter-battery fire.[166] The British could continue these repeated

[164] Griffith, ed., *British Fighting Methods in the Great War*, 41.

[165] Bailey, ed., *Field Artillery and Fire Power*, 149.

[166] Ibid., 151.

attacks in depth through the Hundred Day Offensives because of its excellent rearward logistics. This emphasis on the logistically feasible, limited-objective piece attack was tied to the ability to support the artillery. This formula, adopted after the failures of the Somme, became effective through the simultaneity of the Allied Offensives under a unified commander, Foch. This concurrence ultimately exhausted the Germans and resulted in an Allied victory.

1918 Neutralization and the Threshold of Operational Depth: The French

In the last year of the war the French concept of operational depth crystalized into a firepower centric bounding of limited attacks along a broad front. After the failure of the Nivelle Offensives, Marshall Pétain ascended as the Commander in Chief of the French army. The general carefully rebuilt the fighting capacity of the French army through a defense in depth and abandoning the breakthrough offensives. This patient strategy harnessed French material superiority and created time for American reserves to arrive on the Western Front. Pétain published directive no. 2 in December 1917 in an attempt to add more flexibility into French operations. This document stressed the importance of surprise and the need to abandon methodical plans in favor of orders.[167] However, Pétain faced a great deal of opposition from commanders who preferred a methodical approach to operational depth. However, after the Germans pushed back the British to the outskirts of Amiens, the Allies appointed General Foch as supreme commander of the Allies. Foch likened the elastic defense in depth to a retreat.[168] The clash between France's two most important generals influenced the army's ability to carry out Pétain's reforms. Additionally, this doctrine delivered from the top down did not circulate the French army in the manner German doctrine did. Therefore, generals and staffs often misapplied key concepts. Additionally, commanders complained they did not have the time to build positions

[167] Allan R. Millett, *Military Effectiveness: First World War* (Cambridge, MA: Cambridge University Press, 2010), 211.

[168] Lucas, *Evolution of Tactical Ideas in France and Germany during the Great War of 1914-1918*, 145.

four to five kilometers in the rear.[169] However, the Commander in Chief did manage to create a sizable operational reserve of 45 divisions. Therefore, at the tactical level the French did not have the capacity to halt German infiltration tactics, but it retained the capacity at the operational level to contain them.

The French army was unevenly prepared to resist the initial Spring Offensive, but its operational depth enabled the French to endure and overcome the Germans. During the third German offensive known as the Blücher-Yorck phase, the French defeat demonstrated how Pétain's model of depth was not universally adopted. General Denis Auguste Duchêne, a protégé of Foch, willfully disregarded Pétain's directive to defend in depth.[170] As the commander of the French 6th army, Duchêne massed the bulk of his army on a single line with little to no regard for tactical reserves. Unwilling to cede any ground on the path towards Paris, the 6th Army could be attacked throughout its tactical depth with massed heavy artillery. The Germans aimed to shift Allied reserves away from the British through seizing limited objectives against the French. After a Bruchmuller bombardment consisting of three million shells fired in a single day, the Germans shattered the 6th French army throughout its tactical depth.[171] Despite the tactical failure, Pétain created 'moles of resistance' on the German flanks through reinforcement from operational reserves. This tactical action set conditions for a simultaneous counter-attack against the flanks of the German salient, which failed due to a lack of synchronization. Foch shifted reserves and heavy artillery from unthreatened sectors to close the gap. The French maintained rearward operational depth created by Pétain's defensive methods and Foch's ability to shift operational reserves through rail and motor transport. The further the Germans advanced, the greater the exposed salient with a long perimeter, hasty defenses, and weak communications. The French

[169] Millett, *Military Effectiveness: First World War*, 220.

[170] David Stevenson, *With Our Backs to the Wall: Victory and Defeat in 1918* (Cambridge, MA: Belknap Press, 2011), 81.

[171] Ibid., 83.

operational depth wore down the Germans to a point where French could mass their material strength against the Germans weakness, the flanks of the salients.

The counter-offensives during the Hundred Days Offensive embodied the French concept of operational depth through flexible attacks supported by massed heavy artillery against German salients. The French counter-stroke aimed at the Champagne salient, which threatened Paris and also served as the main line of German communications. Pétain and Foch devised a scheme that that linked a defensive battle tied to a blow against the German flank.[172] The counteroffensive plan consisted of a 105 kilometer front by four armies attacking from the south, west, and east cut off the base of the salient and encircle its defenders. In order to maintain surprise, the French concentrated using night movements over four nights. The French did not use a long preliminary bombardment, but instead relied on the shock of over 1,000 aircraft and 500 tanks.[173] The French achieved a penetration needed for operational depth through surprise and massed capabilities to include armor, airpower, and artillery. Most importantly, the impact of simultaneity against the vulnerable salient devastated the Germans. The Allies began to arrange tactical actions to achieve an operational effect rather than a linear breakthrough. The French committed 50 divisions and regained much of the lost ground from the German Spring offensive. By the time the front stabilized in August, Foch sought to use this model of operational depth on a larger scale.

The French conception for the final offensives incorporated Pétain's limited objective attacks, but with a faster tempo between attacks along the entire front. In a position paper, General Foch asserted that the Germans suffered from a 'crisis of effectives.' Therefore, a succession of surprise attacks at quick intervals would prevent the Germans from employing their reserves through attacking multiple salients.[174] This method of achieving operational depth did

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[172] Foch, Memoires pour Servir a l'Historire de la Guerre de 1914-1918, II (2 vols., Paris: Les Petits-Fils de Plon et Nourrit, 1931), 142.

[173] Stevenson, *With Our Backs to the Wall: Victory and Defeat*, 114.

[174] Doughty, *French Operational Art 1888-1940*, 89.

require a breakthrough, but instead relied on a several strong attacks along converging lines. The enemy could not reinforce one area without weakening another. Operational depth required surprise and simultaneity on a large scale to ensure the attacker was stronger than the defender. This concentrated effort at select points by deep fires enabled the overmatch. The series of limited attacks required rearward depth to project power forward. The leapfrogging of men, material, and supplies prevented culmination at the cost of a slower tempo. The French harnessed this operational depth in concert with the British and Americans to exhaust the Germans and win the war.

1918 Neutralization and the Threshold of Operational Depth: The United States

When the United States entered the war in 1917, it was remarkably unprepared for the task ahead. Yet by the armistice of 1918, the United States played a decisive role in the defeat of Germany and created a unique form of operational depth. The United States overcame a lack of experience, logistical barriers, and political pressure to amalgamate its army. Prior to the entry into the war, the United States' operational thought and doctrine centered on open warfare inscribed within *1914 Field Service Regulations*. However, by the end of 1917, the Allies resorted to a 'bite and hold,' or methodical approach. The United States' concept of depth emerged from the tension between adherence to the principles of the *Field Service Regulations* and a methodical firepower centric approach learned through combat experience. The American Expeditionary Force's (AEF) doctrine, composition, and operational experience during the Saint-Mihiel and Meuse-Argonne campaigns led to a synthesis from these two methods, which led to a unique concept of depth.

The *1914 Field Service Regulations* served as the combat doctrine throughout the Great War. This work resembled the doctrine of the majority of European powers on the eve of the

Great War.[175] This doctrine codified an approach known as open warfare. It espoused the belief that the infantry as the "principle and most important arm" achieved mass through mobility and rifle power.[176] The doctrine's principle shortfall in 1917 was a lack of emphasis on the integration of machine guns, artillery, and logistics. Despite the reports from the Western Front, the pre-war leadership forbade firing barrages and conducted minimal combined training between the infantry and artillery in peacetime. Colonel Conrad H. Lanza, a senior AEF artilleryman, characterized the prevailing belief that "the artillery was considered an auxiliary, sometimes useful, never necessary, and sometimes a nuisance."[177] Pershing believed that the aggressive tactics of open warfare supported by American manpower could create a breakthrough. However, Allan R. Millet stated Pershing placed too much faith in the ability of the individual infantry to overcome the fire power of modern weaponry.[178] Millet holds a common held belief that the AEF's theoretical foundation sought to achieve operational depth through infantry centric maneuver to achieve a breakthrough. The revisions to *FSR* and actual operational achievements reveal a more mature and complex understanding of the operational art. Pershing's vision of warfare is only superficially out of step with the French and British. The United States' doctrine performed the vital task of providing a common framework in which to adapt to the conditions of the Western Front. The operational composition of the divisions, corps, and AEF provided the requisite background to understand why the concept of open warfare and set-piece attacks merged.

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[175] Mark Ethan Grotelueschen, *The AEF Way of War: The American Army and Combat in World War I* (New York: Cambridge University Press, 2010), 15.

[176] United States Government, *Field Service Regulations, United States Army 1914* (New York: War Department, 1914), 67.

[177] Conrad H. Lanza, "The Artillery in Support of the Infantry in the A.E.F.," The Field Artillery Journal (January-February,1936): 84.

[178] Millett, *Military Effectiveness: First World War*, 180.

The AEF staff assimilated lessons from the British and French to design a force capable of "powerful blows of depth."[179] Leavenworth trained officers constructed a force capable of depth through a square organization at the corps and division level. This design provided an operational capability to continue an offensive with an enemy that could not afford an attritional contest. The square division and corps enabled two subordinate elements in the attack with two in reserve. The large divisions and corps provided the instrument that extended operations in time and space.[180] *FSR* required this type of force to create a crushing blow using infantry to penetrate the enemy line, race through the gap, and destroy the enemy remnants in the open.[181] As an expeditionary force, the United States needed to employ depth to wear down the Germans because of the distance required to replace forces. The French filled the professional and material gap required to employ modern artillery. The AEF borrowed heavily and exclusively from the French. American artilleryman incorporated translated French manuals, instruction courses, and rotational on the job training as a doctrine.[182] This wholesale adoption of French material and methods provided a counterweight to an untested *FSR*. This training enabled the Americans to execute rolling barrages and deep fires throughout an enemy's tactical depth. Prior to the formation of the 1st Army as an independent force, American divisions wrestled with employing open warfare and methodical attack. The experience of 2nd Infantry division during the Aisne-Marne campaign provided a fitting example on how these two contrasting concepts defined the American operational experience.

The 2nd Infantry Division's experience at Belleau Wood illustrated the pattern that combined open warfare and methodical battle. The division's initial attacks at Belleau Wood by

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[179] Richard W. Stewart, ed., *American Military History, vol. II* (Washington, DC: U.S. Army Center of Military History, 2010), 14.

[180] *ADRP 3-0*, 2-14.

[181] Grotelueschen, *The AEF Way of War: The American Army and Combat in World War*, 28.

[182] Gudmundsson, *On Artillery*, 137.

weakly supported infantry in linear formations ended in disaster.[183] The commander, BG James Harbord, thought that he could achieve the principles of *FSR* with only aggressive self-reliant infantryman. Harbord, a disciple of the official doctrine, allocated only 1/5 of the division's artillery to the assault in order to achieve surprise.[184] With no rolling barrage, the fire focused excursively on interdiction and rear areas. The 2nd Division learned at a high cost of 1,087 casualties in a single day that attacks cannot succeed without close supporting firepower.[185] This first lesson in positional warfare demonstrated that any attack must be conducted as a combined arms team to achieve any measure of depth. Despite the courage and determination displayed by the marines, operational leaders started to realize the importance of combined arms. BG Harbord ordered two set piece attacks with rolling barrages, which achieved gains at a lower cost. However, the commander, impatient at the lack of progress, reverted to unsupported attacks and again suffered heavy losses. By the 24 June 1918, Habord resorted to set-piece attacks that cleared the remaining Germans from the Belleau Wood. On the 1st of July, the division incorporated the hard learned lessons into an effective combined arms set-piece attack on the village of Vaux. A comprehensive preliminary bombardment throughout the entire German tactical depth made possible by painstaking reconnaissance overwhelmed the German defenses. Additionally, the division augmented each infantry battalion with a company of engineers and machine gun teams. This combined arms attack inflicted 926 German casualties at a cost of 328 Americans injured forty seven deaths.[186] The 2nd Infantry division learned, at a high cost, the pre-requisites for a tactical penetration Any breach required a combined arms team that, at a

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[183] Grotelueschen, *The AEF Way of War: The American Army and Combat in World War*, 207.

[184] Mark E. Grotelueschen, *Doctrine under Trial: American Artillery Employment in World War I* (Westport, CT: Praeger, 2000), 36.

[185] Edward Coffman, *The War to End All Wars: the American Military Experience in World War I* (Lexington: University Press of Kentucky, 1998), 217.

[186] Grotelueschen, *Doctrine under Trial: American Artillery Employment in World War I*, 57.

minimum, synchronized intelligence and fires with maneuver. This lesson learned with a single division served as a singular example of a phenomena that occurred unevenly across the entire AEF.

General John J. Pershing created the American First Army on 10 August 1918 and published a doctrinal revision, "Combat Instructions," that combined the competing visions of operational depth. Pershing ordered a reexamination of American methods due to the heavy losses in the Spring. The investigation's result married the principles of open warfare with the proven methods of methodical attack. George C. Marshall summarized the guiding principle "Combat Instructions for Troops of the First Army" as a "breakthrough of carefully fortified positions, followed by fighting in the open."[187] The doctrine continued to stress self-reliant infantry and downplay the importance of detailed attack plans supported by heavy artillery. However, in practice AEF largely ignored this misplaced emphasis throughout the two final campaigns.[188] The instructions divided major attacks into three phases, which each required their own unique set of tactics. The first section, "Preparation of the Forward Zone (trench warfare)," validated the doctrine and tactics by the Allied armies and subordinates' organizations such as the 2nd Infantry Division.[189] This section emphasized the importance of synchronized combined arms, which included a rolling barrage, tanks, and neutralization fire for 3-4 kilometers. Beyond the first zone, the old principles of open warfare would be applied to the "advance across the Intermediate Zone" that culminated in a third zone "Exploitation." The second and third zones lay past the enemy's main line of resistance and beyond the range of friendly division artillery. The doctrine emphasized fire superiority to enable small units to flank or overwhelm strong points.

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[187] George C. Marshall, *Memoirs of My Services in the World War, 1917-1918* (Boston: Houghton Mifflin, 1976), 126.

[188] Grotelueschen, *The AEF Way of War: The American Army and Combat in World War*, 45.

[189] Ibid., 46.

"Combat Instructions" strongly resembled German neutralization and infiltration tactics, but without the emphasis on firepower to create the initial penetration. Additionally, the inability to support this method of fighting logistically also paralleled the Germans. Overall, this revision exhibited a mature concept of depth that combined set-piece attacks at the tactical level with open warfare at the operational level.

First Army's first offensive, the attack to reduce the St. Mihiel salient demonstrated the potential for the AEF's unique vision of operational depth. The original purpose for the attack at St. Mihiel was to achieve a breakthrough and capture the vital logistic hub of Metz. The preparation for this attack exemplified rearward depth that could support a penetration into the German operational depth. The AEF constructed over forty-five miles of standard gauge and 250 miles of light railway to move over forty thousand tons of ammunition through nineteen railways. Signal communication consisted of telephone lines, radio, and pigeons with separate nets for artillery, air services, and logistics.[190] The St. Mihiel offensive was the largest American joint and combined operation to date. The AEF sought to create forward depth with simultaneity and synchronization to extend beyond the initial penetration into the German's operational depth. The AEF's main attack by I and IV Corps against the southern portion of the salient while V Corps attacked the western side of the salient prevented the Germans from halting the attack with their reserves. The division's synchronization with the artillery, tanks, and air corps created the shock that collapsed the first line of defense The air corps attacked railheads, command posts, enemy airfields and bridges within the intermediate zone.[191] The artillery supported the advance of the infantry, destroyed obstacles, conducted counter-battery, and supported the interdiction within the intermediate zone. Several hours after the attack commenced, the AEF employed coastal guns

[190] John J. Pershing, *My Experiences in the World War Volumes 1 and 2* (New York: Frederick A. Stokes, 1931), 260.

[191] Michael R. Matheny, *Carrying the War to the Enemy: American Operational Art to 1945* (Norman: University of Oklahoma Press, 2012), 35.

against railway centers to disrupt German reserves and supplies to the main line of resistance.[192] This tactical action extended operations in time and space, because it lengthened the time the AEF had to penetrate the tactical depth of the Germans. Hunter Liggett, the I Corps commander described how fires created operational depth with the statement that, "the artillery of the enemy was overwhelmed, his communications destroyed, and all his defensive measures demoralized by fire… created immense damage to the defensive organizations of the enemy, with sufficient leeway to permit our troops to reach the vital points in our advance before the enemy reserves could possibly intervene in sufficient strength to stop our movements."[193] The commander described how combined arms enabled the efficient penetration into the operational depth of the German field fortress of St. Mihiel.

However, this attack remained limited because Field Marshal Foch envisioned a series of converging attacks against German lateral lines of communication in the opposite direction of Metz. [194] This necessitated a British attack through Flanders towards the southeast and a combined French and American attack north through the Meuse-Argonne region to seize Sedan in an immense double envelopment. The AEF needed to move over 600,000 men into the new attack zone, and conduct the campaign to help end the war.

The plan for First Army's Meuse-Argonne campaign combined a set-piece attack within the initial objectives and open warfare for the secondary objectives. Overall, this plan harnessed a mixture of surprise, simultaneity, and integrated planning. The AEF needed to achieve forward depth through penetrating the tactical depth of the German main line of defense faster than it could be reinforced by its operational reserve. Surprise served as the key initial factor through a

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[192] Joseph Metcalf, *The United States Naval Railway Batteries in France* (Washington, DC: Government Printing Office, 1922), 16.

[193] Hunter Liggett, *Commanding an American Army,* 2nd ed. (Boston: Houghton Mifflin, 1925), 65.

[194] Stewart, American *Military History, vol. II*, 41.

shortened bombardment, deception by the formation of a fictional American Tenth Army in the St. Mihiel sector, and the enormous redeployment planned by George C. Marshall.[195] The initial attack consisted of a textbook set piece attack that required a massive concentration of heavy artillery. The offensive consisted of a three stage advance towards the strategic rail hubs between Carignan, Sedan, and Mézières. Pershing set the overly optimistic objective for the first day as a complete penetration of the main defensive system, the *Kriemhilde Stellung*, clearance of the Argonnne Forest, and link up with the Fourth French Army at Grandpre. [196] Pershing envisioned for the second stage as a return to open warfare. This object laid ten-mile deeper and consisted of three mutually supporting corps focused on the key terrain of the Meuse-Heights. The third stage entailed the captured the rail hub at Mézières and, in concert with the British and French offensives from Cambrai to St. Quentin, which severed the German logistics into France. This plan clearly demonstrated an aim to achieve operational depth through employing set-piece attacks to create an initial penetration. Once through the initial trench network, the Americans would transition to open warfare by corps who fixed and bypassed strong points to destroy German reserves and logistics. However, the conduct of the campaign would reveal that these objectives would unrealistic due to a myriad of factors.

The initial attacks for the Meuse-Argonne offensive achieved initial success, but failed to create a breakthrough into the enemy's operational depth due to rough terrain, logistical failures, and an inability to command and control. The initial attack achieved surprise due to the same factors that made St. Mihiel successful: simultaneity, surprise, and detailed planning required for a set-piece attack. On the first day, a lack of coordination between two adjacent corps led to a missed opportunity to cut off Montfaucon. The AEF utilized motorized artillery to sustain the

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[195] Lengel, *To Conquer Hell: the Meuse-Argonne, 1918 the Epic Battle That Ended the First World War*, 61.

[196] Coffman, *The War to End All Wars: the American Military Experience in World War I*, 301.

forward momentum required of open warfare. Yet, the transportation difficulties, weather, and terrain made it near impossible to move artillery forward to support the seizure of intermediate objectives. By the second day, the German defense increased with a reinforcement of six divisions as the American organization broke down.[197] The open warfare ascribed in "Combat Instructions" did not match the tactical reality on the Meuse-Argonne battlefield. Even hastily prepared defenses could inflict grievous casualties. Colonel Lanza asserted that no attack succeeded without sufficient artillery support throughout the initial phase of the campaign. [198]. Instead, the initial phase created logistical logjams and exhausted the AEF. The AEF required a series of operational pauses to reorganize its rearward depth, move forward its artillery, and prepare a sequence of set piece attacks. The AEF accepted the practice of bounding of limited attacks which consistently wore down the German defenses.

In the final phase of the Meuse-Argonne offensive, the AEF demonstrated the true potential of the American form of operational depth. From mid-October to 1 November, Hunter Liggett, the new commander of First Army, addressed the tactical problems that plagued the campaign. First, Liggett directed artillery-infantry coordination training, and reorganized his logistics, or rearward depth. Second, the tactical plan utilized combined arms fire and maneuver to achieve an efficient initial penetration. One corps suppressed an enemy emplacement while a second group maneuvered to destroy it.[199] Additionally, over four days prior to the attack, huge 14-inch navy guns, mounted on railway cars, devastated 25 miles into the German rear area.[200] Once the combined arms attack commenced, corps and army artillery its effort on interdiction

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[197] Matheny, *Carrying the War to the Enemy: American Operational Art to 1945*, 40.

[198] Conrad H. Lanza, *The Army Artillery, First Army* (Carlisle, PA: United States Army Military History Institute, n.d.), 362.

[199] Lengel, *To Conquer Hell: the Meuse-Argonne, 1918 the Epic Battle That Ended the First World War*, 385.

[200] Coffman, *The War to End All Wars: the American Military Experience in World War I*, 345.

fires against German reserves, lines of communication, and neutralization of its artillery.[201] The synchronization among the corps level attacks with the shaping efforts diverted reserves away from the main effort. As result of a synchronized combined arms set-piece attack, the AEF broke through the enemy's main line of resistance, advanced nine kilometers, and suffered only light casualties.[202] The AEF achieved operational depth because they overran four divisions and they could not establish a new line of defense. The enabled a rare transition to pursuit to exploit the breakthrough.

The American concept of operational depth formed from its pre-war theoretical foundation, French instruction in set-piece attacks, and most importantly practical experience in the final campaign. In less than two years, the United States transformed from a constabulary force to a modern army capable of operational depth. The AEF arrived in France with a coherent but untested doctrine. With support from the Allies, the AEF acquired the means and knowledge to incorporate heavy artillery. A pattern emerged from the practices throughout out the summer campaigns of 1918 that merged these two concepts into a unique form of depth. The AEF learned through hard fought lessons that artillery provided the best means to create a penetration that opens the door into German operational depth. Artillery also provided the ideal means at that time to shape the deeper intermediate zone. The Allies' desperate need for troops, doctrinal ambiguity between trench and open warfare, and inexperience prevented the AEF from creating operational depth with a breakthrough sooner. However, the armistice ended the war just as the AEF honed its unique blend of aggressive open warfare and methodical attack.

1918 Neutralization and the Threshold of Operational Depth: Conclusion

During the final campaigns of the war the Allied and Central powers exhibited two distinct forms of operational depth. Among the United States British, French, and Germans

[201] Lanza, *The Army Artillery, First Army*, 385.

[202] Grotelueschen, *Doctrine under Trial: American Artillery Employment in World War I*, 123.

shared several key characteristics such as surprise, tempo, and firepower to achieve depth. However, the manner and scope varied greatly. The Germans attempted to achieve operational depth through tactical excellence at the cost of logistical preparation. The combination of Bruchmüller neutralization bombardment, infiltration tactics, and disruption of the enemy's rear created tactical success, but failed without adequate operational support. Without adequate logistics and manpower reserves, the Germans could not overwhelm the Allies. The Allied solution relied a combination of technical innovation married with a sequential leapfrogging of concentrated attacks at vulnerable German positions along the entire Western Front. The Allies could not replicate the level of training necessary to assault tactics, but instead achieved operational depth through simultaneity and surprise. The depth became truly operational through the logistical support of Allied artillery. The slower and sequential attacks did not end in culmination, because each attack was properly resourced with artillery. The United States possessed the most mature conception of operational depth, but lacked the time exercise it. The Germans could not cope with the Allies ability to harness operational depth and sought an armistice.

Conclusion
The Threshold of Operational Depth

It is critical to realize that the origins of operational depth laid in the change and response dynamic among the major combatants' employment of fire support. The pre-war theory and doctrine combined with the technical advancement of firepower shattered the existing concept of depth. The intense interest in Napoleonic warfare fixed military thought on maneuver and mobility rather than firepower, which misjudged the impact of modern weapons.[203] This misinterpretation blurred the distinction between the strategic and tactical levels of war. The distortion resulted in a campaign that culminated with unprecedented casualties and stalemate. The Germans attempted to achieve depth through a magnification of the tactics from the Battle of Cannae without the requisite logistics and communications. From this initial shock, artillery served as the primary agent towards greater operational depth. After the fall of 1914, all campaigns were fought along lines of operations best suited to employ artillery. With this new tool, the great powers sought to achieve operational depth through pre-war conceptions through the breakthrough or pragmatic approaches such as the 'bite and hold.' Regardless of the approach, operational depth required rearward depth, synchronized combined arms, and certain principles that enable forward depth.

In order to reach the operational depth, the tactical problem of how to penetrate a series of networked lines of trenches faster than an enemy could reinforce itself needed to be solved. Artillery became both the solution and problem for this puzzle. In 1915, the Allies attempted to use massed firepower and forces against a single point. A combined arms synchronization between infantry and artillery resulted in the first penetrations by the French and British in 1915. These experimentations revealed that operational depth as the extension of operations of time and space required rearward depth to sustain a projection of depth forward.

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[203] Doughty, *French Operational Art 1888-1940,* 75.

Despite the failure to achieve a breakthrough, the Allies uncovered a vital pre-requisite of operational depth, rearward depth. In order to overcome the tactical problem of a continuous front. The Allies resolved to mass heavy artillery to destroy the tactical depth of the shallow German defenses. This required a rearward depth in the form of logistical support to facilitate the massive consumption of artillery ammunition. A deliberate establishment of infrastructure in the form of roads, rail, and depots to enabled the concentration of massed artillery. When this rearward depth broke down because of bottlenecks, the Allies could not transition to a pursuit. The logistical support and planned movement of reserves to enable a pursuit intertwined with the second dimension of forward operational depth.

Artillery provided the sole means to achieve the forward depth in an era of trench warfare. The Allies resolved to use massed artillery to create a penetration required for the operational breakthrough. In order to overcome the challenge of infantry-artillery synchronization, the Allies used inflexible time tables. Once beyond the range of friendly artillery or communication, every attack failed. This method provoked a response to greater rearward tactical depth, because concentrated infantry in the first line of defense was highly vulnerable to massed artillery. The Germans adapted throughout 1915 into 1916 with greater rearward dispersion, which enabled the absorption of massed artillery through placement of forces outside the range of artillery.

The Allies countered the greater German tactical depth with immense amounts of massed heavy artillery and technical innovation such as armor, which required greater rearward depth. This led to an evolution in German doctrine towards an elastic form of defense in depth, which still retained its offensive character. After the victory in the East, the Germans shifted to the offensive in 1918 and attempted to achieve forward depth through tactical excellence. The combination of neutralization fires, infiltration tactics, and disruption of the Allies rear produced the greatest breakthroughs of the war, but failed to achieve the strategic objective. This failure to achieve operational depth stemmed from the inability to communicate and sustain the offensive.

When the Allies regained the offensive in the summer of 1918, they abandoned the breakthrough in favor the 'bite and hold' method. This method relied on surprise, simultaneity, and sequential leapfrogging of massed artillery. At the operational level, Amiens, Meuse-Argonne, and the Aisne-Marne offenses utilized surprise and attacks along a broad front to deny the Germans the use of their reserves. They also required massive investments in rearward depth to support the concentrated artillery. With practice and refinement, the desire to preserve their force led to greater combined arms synchronization. Without the benefit of the technology that would come a generation later, the Allies came to the brink of operational depth. The combination of synchronization, forward, and rearward depth verified the origin of operational depth. No power achieved the decisive breakthrough operation, but instead relied on the constraints and limitations of their times to create effective solutions to the unique problems of the Western Front.

The evolution towards operational depth does not produce a unified theory on warfare, but provided a vital insight to how the Allies and Germans confronted a complex problem. At the dawn of modern warfare, new weapons outpaced the theories and doctrine designed to harness them. The airplane, quick firing artillery, tank, chemical warfare, and radio are taken for granted in today's military. However, at the time they were often misunderstood by the commanders and staff that sought to harness their lethality. Leaders such as Haig, Foch, and Pershing held onto their existing pre-war conception of depth, the breakthrough and suffered prohibitive losses. Artillery stood out among these tools, because it was both the obstacle and the vehicle towards operational depth. In order to utilize the lessons of this study, we must look inward and to the future to harness operational depth. The importance of synchronization, simultaneity, surprise, and logistics are as true today as they were in 1914. As new ways of warfare emerge, we do our utmost to achieve rearward and forward operational depth across all domains. We cannot predict the future character of warfare. It does not matter if the next artillery appears in the form cyber-

warfare or swarms of drones. If we do not understand the origin of depth, we will not be prepared to meet the challenges and opportunities of tomorrow.

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